

FRIDAY, MAY 18, 1883.

*THE SOCIETY OF NATURALISTS OF
THE EASTERN UNITED STATES.*

In answer to a call dated March 31, a number of working naturalists met at Springfield, Mass., April 10, to consider the advisability of organizing a society for the discussion of methods of natural history work. In the discussion which followed the election of Professor Hyatt to the chair, it was shown that every one present had often felt the need of opportunities to meet other workers in his own special field with whom to discuss such topics as methods of laboratory work; laboratory technique; new and valuable processes of staining, mounting, cutting, and preserving sections; different systems of instruction in various departments of natural science; methods with small elective classes, or with large college classes; the position which the sciences of observation should hold in the college curriculum; the amount of natural science which should appear in college entrance examinations; the amount and character of such instruction essential in preparatory schools; museum interests; mutual aid or co-operation between different museums; methods of museum work; methods of exhibition; and similar topics.

While there are many opportunities for the publication of the results of scientific work and investigation throughout the country, and for keeping up with current results, there has existed heretofore no association where such subjects as those above named could be made the chief topics of discussion. The need of an association devoted to such technical purposes is certainly as great at the present time, when science is beginning to take its proper place in the curriculum of all educational institutions, and laboratories and museums are springing up all over the country, as was the need in earlier days for founding the American association for the advancement of science. Published essays can be read at home; but for the right understanding of difficult manipulation in the laboratory, of methods of instruction either in the laboratory or class-room, or for any

efficient co-operation, it is essential to meet and talk with the originator of the method, or with one who is well versed in its application. The worker in natural science knows that in every laboratory new points are being constantly developed, which, though of value for saving time or labor, are frequently never published.

At the meetings of this society there will be special opportunities for getting such information from a number of laboratories where work is constantly going forward. Again: the meetings will furnish chances for those at home to meet and question the many American naturalists, who, on their return from visiting or working in the best laboratories in England and Europe, bring with them the latest methods in vogue on the other side of the Atlantic, — a number which may increase, now that an American table at Döhrn's zoölogical station, Naples, is held by Williams college.

The work of organization occupied nearly all the time at the Springfield meeting; but, in the brief informal discussions which followed, the opinion was very generally expressed, that one of the most important questions with which we have to deal, and one which needs immediate attention, is the preparation necessary for the study of natural science in colleges. The great difficulty in making a success of college instruction in the sciences of observation lies in the fact that not one young man in twenty knows either how to observe, or how to think about facts of observation. His education in that line is very deficient, or else entirely wanting; he is utterly helpless without his books, and seems quite unable to see or to correlate facts for himself. No other branch of the curriculum is so inefficiently treated by the preparatory schools and academies. It is the reverse of right, that the college professor, with a class of from forty to eighty men, should have to make the vain attempt to teach the lowest step in the observational sciences. Methods which can alone guarantee success in imparting to the eye and the mind the rudiments of science cannot be employed under such conditions. Moreover, it is a matter for

the deepest regret, that young men who are soon to be in places in the world where they have no books, and where the keenest exercise of the powers of observation, and the judgment of facts are demanded, should in so many cases have no opportunity, or next to none, either in school or college, for the acquisition of a training upon which the success of their life-work, in the larger number of professions and occupations, is dependent.

It is to be hoped that one needs only to mention such objects as these, to bespeak for this new association the sympathy and support of all naturalists and earnest workers in science.

At the concluding session of the meeting just held, the society elected the following officers: president, Professor Alpheus Hyatt, curator of the Boston society natural history; vice-presidents, Prof. H. Newell Martin, Johns Hopkins university, Prof. A. S. Packard, jun., Brown university; treasurer, Prof. William B. Scott, Princeton college; secretary, Prof. Samuel F. Clarke, Williams college.

At the same session, a constitution, which had been drawn up by a committee of three, was read and adopted. In it the object of this society is stated to be "the association of working naturalists, for the discussion of methods of investigation and instruction, laboratory technique and museum administration, and other topics of interest to investigators and teachers of natural history, and for the adoption of such measures as shall tend to the advancement and diffusion of the knowledge of natural history in the community."

Membership in the society is limited to instructors in natural history, officers of museums and other scientific institutions, physicians, and other persons professionally engaged in some branch of natural history. Any member may present to the executive committee names of candidates for membership, but only those candidates who are approved by the executive committee may be elected to membership by a majority of the members present at any meeting of the society. The annual fee for membership is two dollars.

The officers are elected by ballot at the annual meeting of the society, their official term commencing at the close of the meeting.

The five officers of the society constitute the executive committee, who are to recommend to the society, from time to time, such measures as they may deem expedient for the purposes of the society.

The proposed meetings of the association are to be held only in the New England and Atlantic states north of Virginia. They are not fixed to one locality, but are peripatetic; and it is intended to have them held in different college and university towns, to facilitate means of illustration.

The annual meeting is to be held on the second Wednesday of March in each year, unless otherwise ordered by the executive committee; and special meetings may be appointed at any time by a vote of the society or of the executive committee. The second meeting, for instance, is to be held in New York during the next Christmas holidays.

It is also declared to be the policy of the society, by correspondence and otherwise, to encourage the formation, and co-operate in the work, of societies of similar name and object in other parts of the country. We are informed, indeed, that a request for the formation of such an organization in the west has already been received, and favorably reported on.

We understand that some objections have been raised to the formation of a society distinct from the American association; but it will be evident from this sketch of its plan, that at present it is neither general enough in its object, nor broad enough in its geographical field, to permit of working in connection with the larger organization.

THE MATHEMATICAL TRIPOS IN THE UNIVERSITY OF CAMBRIDGE.

IN January of this year the list of successful candidates for mathematical honors at the University of Cambridge was published under new rules, which provide, among other things, that the names shall be finally arranged alpha-

betically, and not, as heretofore, in the order of merit.

Under the old system, the tripos examination began generally on the first Monday in January. Two papers were set on each of the first four days of that week; then followed an interval of ten days, during which the work of the candidates was examined, and a list of those who had "acquitted themselves so as to deserve mathematical honors" published; finally, all such persons, but no others, were admitted to the rest of the examination, which consisted of a five-days' further test in the more difficult parts of mathematics and natural philosophy.

The names of all the candidates previously declared to be deserving of honors were then arranged in the order of merit, determined by the work of all the nine days, "into three classes of wranglers, senior optimes, and junior optimes;" and this list, which, of late years, generally contained about a hundred names, was then published in the Senate House.

The regulations¹ for the mathematical tripos examination directed that in no book-work paper of the first six days should be contained more questions than well-prepared students might be expected to answer within the time allowed for the paper; but they sanctioned the introduction, in all the subjects, of "examples and questions, by way of illustration or explanation, arising directly out of the propositions themselves." This last rule enabled the moderators and examiners to attach a rider to almost every question, and thus to increase the length of the papers far beyond what even the ablest man could write out properly in the time allowed.

An examination of the papers of the last ten years shows, that, in the fifteen papers devoted each year exclusively to book-work, most of the questions were such as a very well read man might have met with in the course of his studies; but that a very large proportion of the riders must have been new to all the candidates, and of such a nature as to test very effectually the power to do new work which the men had gained.

The great honor which has been always attached to the senior wranglership has given rise to the sharpest rivalry for first place; and this rivalry has extended to the tutors as well as to the candidates themselves. With the names of the six or eight men who stand highest in the list of wranglers, some of the daily papers have been in the habit of printing short

accounts of their lives, and of giving the names of the teachers who prepared the men for the examination.

As a result of this, the most famous tutors were said to refuse all students who did not give promise of getting a good place in the list of honors; and those young men who were so fortunate as to secure the services of one of the celebrated 'senior-wrangler manufacturers' were more carefully looked after and trained than are the race-horses for the Derby.

There has been a continual struggle between the examiners and the tutors. The former have attached, each year, difficult and ingenious riders to comparatively easy book-work questions; so that in many cases the connection between the two is by no means obvious. The latter have tried to send up candidates so well read, and so well trained in the solution under pressure of new problems, that the amount accomplished should depend only upon the rapidity with which the student could write.

Let a person who has not had the benefit of this coaching attempt to write out one of the easier tripos¹ papers in a time equal to that originally allowed for it, and, whatever he may think of the wisdom of requiring a student to be prepared for examination in so many subjects at one time, he must get a profound respect for the ability, the attainments, and the *physical endurance*, of those who get places in the tripos. As far as one can judge from such accounts of the lives of higher wranglers as appear in the newspapers, the more ambitious students have, of late years, come up to the university with a good knowledge of analytic geometry, differential calculus, and mechanics. They have then spent nearly three years — studying in vacation as well as in term-time — in a special preparation for the examination for honors, and finally have been subjected to the terrible strain of writing the nine-days' papers. One cannot wonder that many students broke down in the course of preparation, and that many others succeeded in getting high rank at the price of lasting ill health.

Mr. Todhunter, in his 'Conflict of studies,' was one of the first to raise his voice against the system; but he was soon joined by others, who argued that the test of the students' powers would be quite as effective, and the evil results of the preparation fewer, if there were an interval of several months between the examinations in the more elementary subjects

¹ Cambridge university calendar for the year 1879, pp. 25-28.

¹ The tripos papers for each year make a quarto pamphlet, which may be had of Messrs. George Bell & Sons, Cambridge warehouse, 17 Paternoster Row, London. Price two shillings.

and in those of the last few days. Finally, after a good deal of agitation, a new system of regulations for the mathematical tripos examinations, to go into effect after January, 1882, was made and published in 1879. By these new rules, the whole examination is made to consist of three parts of three days each. The examination in part I., which is to begin on the Monday before the first Sunday in June, will be confined to Euclid, arithmetic, ordinary algebra, and the first three sections of Newton's Principia, with the elementary parts of trigonometry, geometrical conics, statics, dynamics, hydrostatics, optics, and astronomy. As Mr. Besant remarks in the 'Students' guide to the University of Cambridge,' however, "the word 'elementary' simply implies that the subjects in question are to be developed, as far as they can be, without the aid of the elaborate machinery supplied by modern analysis. In other words, the methods of pure geometry and ordinary algebra and trigonometry are to be the only instruments employed; and the effect of this restriction is, in many cases, to make the treatment of mathematical ideas more difficult, and to call out a more direct and powerful application of intellectual energy." From the results of this examination, the moderators and examiners are to publish a list of persons who have acquitted themselves so as to deserve mathematical honors; and these persons only are to be admitted to the examination in part II., which is to begin on the Monday after the second Sunday in June, and to cover algebra, trigonometry (plane and spherical), theory of equations, easier parts of analytic geometry (plane and solid, including curvature of curves and surfaces), differential and integral calculus, easier parts of differential equations, statics (including elementary propositions on attractions and potentials), hydrostatics, dynamics of a particle, easier parts of rigid dynamics, easier parts of optics, and spherical astronomy.

The moderators and examiners are then to publish a list of the candidates, taking into account parts I. and II., and arranging the men, in the order of merit, into three classes of wranglers, senior optimes, and junior optimes. The wranglers only are to be admitted to the examination in part III., which is to begin on the first Monday of the next January, and to cover the advanced parts of the following subjects:—

Group A.—Differential equations; calculus of variations; higher algebra; theory of equations; plane and solid analytical geometry; finite differences; higher definite integrals; el-

liptic functions; theory of chances, including combination of observations.

Group B.—Laplace's and allied functions; attractions; higher dynamics; Newton's Principia, bk. I., sects. ix., xi.; lunar and planetary theories; figure of the earth; precession and nutation.

Group C.—Hydrodynamics, including waves and tides; sound; physical optics; vibrations of strings and bars; elastic solids.

Group D.—Expression of functions by series or integrals, involving sines and cosines; thermodynamics; conduction of heat; electricity; magnetism.

Taking into account the examination in part III. only, the moderators and examiners are to publish in three divisions, *each division arranged alphabetically*, a list of those examined and approved; but they may place in the first division any candidate who has shown eminent proficiency in any one of the groups given above.

It will be seen that this arrangement limits the sharpest rivalry to the work in the more elementary subjects, and taxes the strength of the students far less than the old system did.

The first examination under the new rules was held last June. On the work of the first six days, twenty-nine men were placed upon the list of wranglers. Of these, sixteen offered themselves for examination in part III. in January of this year. Fourteen of these were approved, and the names published in the three divisions provided for. In the first division were placed those who, in last June's list of wranglers, were 1st, 2d, 3d, 6th, and 22d. In the second division the 17th wrangler stood alone. In the third division were the 4th, 7th, two bracketed as 8th, 9th, 16th, 18th, and 19th in the wrangler's list. It will be seen that the last examination changed the order of the names very materially.

The following list of names, made out from an examination of the honor-lists since 1747, will show that a large number of well-known men have taken high rank in the tripos. An asterisk means, that, in the additional examination for the Smith's prize, the person took first place; a dagger is attached to the names of those who took second place.

Name.	Rank as wrangler.	Year.
Maskelyne	7	1754
Erasmus Darwin	21	1754
Archdeacon Paley	1	1763

Name.	Rank as wrangler.	Year.
Lord Ellenborough	3	1771
* Wollaston	1	1783
Malthus	9	1788
* Sir J. Herschel	1	1813
† Peacock	2	1813
† Whewell	2	1816
* Sir G. B. Airy	1	1823
* Challis	1	1825
Willis	9	1826
De Morgan	4	1827
Lund	4	1828
Snowball	7	1828
* Cavendish (Duke of Devonshire),	2	1829
Murphy	3	1829
* Earnshaw	1	1831
Dean Alford	34	1832
Archdeacon Pratt	3	1833
* Kelland	1	1834
† Bishop Colenso	2	1836
Walton	8	1836
Sylvester	2	1837
George Green	4	1837
Gregory	5	1837
O'Brien	3	1838
* Frost	2	1839
† Bishop Goodwin	2	1840
* Stokes	1	1841
* Cayley	1	1842
* Adams	1	1843
Goodeve	9	1843
† Parkinson	1	1845
* Sir William Thomson	2	1845
* Todhunter	1	1848
Westcott	25	1848
* Besant	1	1850
† Watson	2	1850
Wolstenholme	3	1850
* Ferrers	1	1851
* Tait	1	1852
† Steele	2	1852
Godfray	3	1852
* Routh	1	1854
{ J. C. Maxwell	2	1854
Fawcett	7	1856
* Aldis	1	1861
Freeman	5	1861
* Strutt (Lord Rayleigh)	1	1865
W. D. Niven	3	1866
Stuart	4	1866
Niven (Cork)	1	1867
† Clifford	2	1867
† G. H. Darwin	2	1868
* Pendlebury	1	1870
{ Greenhill	2	1870
J. W. L. Glaisher	2	1871
† Lamb	2	1872
Garnett	5	1873
* Burnside	2	1875
† Chrystal	3	1875
Glazebrook	5	1876

THE NEGRITOS OF LUZON.

THE Ajetas, or Negritos, number over thirteen thousand, inhabiting chiefly the wooded mountains of northern, southern, and western Luzon.

They have a dialect of their own. They are probably the aborigines of the Philippines, if not Papuans who went there from the southern groups of New Guinea at a very early period.

They are short in stature, about five feet, slim, with crisp black hair, which they wear as a bushy mop, uncombed because uncombable.

They have not the very flat nose, ugly features, thick lips, and intensely black skin of the African; but their color is dark, lighter in the dwellers in the sun-

less forests, the nose flattened, eyes large and restless, with the sclerotic yellowish. When young, the form is graceful; but the extremes of hunger and repletion, with their almost exclusive vegetable food, give to the adults a protuberant abdomen and lank limbs. The old women look like hags. They have no fixed habitations, but wander in bands of



NEGRITO OF LUZON.



NEGRITA OF LUZON.

fifty to a hundred wherever the supply of food is the richest. Their voices are shrill, and their gestures and agility monkey-like.

They are skilful hunters and fishers. Their arms consist of a bamboo spear, bow and arrows, with a lance-shaped head, often smeared with a resinous poisonous compound. They go nearly naked, the only covering being a narrow band of bark around the loins. Though savage in the interior, and occasionally of necessity cannibal, when brought into contact with the civilized Indians and the priests, they become harmless and confiding. They mix with the Igorrotes and other wild tribes to such an extent that it would be difficult to find one of pure blood out of their native fastnesses. There are a few, probably hybrids, as servants in Manila, docile and trustworthy, whom it would be hard, without careful examination, to distinguish from a negro. They seem to have no religious ceremonies, or ideas of worship; but they respect old age, and venerate the dead.

There is great difference of opinion among ethnologists who have seen these Negritos, as to the race to which they belong. Semper (1869) and Davis (1870:

Journ. anthrop. soc. Lond.), and authors generally, class them among the Papuans. Professor Rudolph Virchow, from the examination of the few skulls brought home by Jagor and others, and in the museums of Germany, denies their affinity to the Papuans, finding the head more monkey-like in form, the glabella extraordinarily developed, the frontal prominences slight, and traces of a frontal median crest; the temporal region elevated beyond the parietal protuberances,

and not quite one-third of an inch behind the coronal suture; width at lower part of nose very great. The bones are weak and delicate, the tibiae laterally flattened, the humerus often perforated at the elbow, with a twist different from that of the European. They have undoubtedly been crossed by invasions of other tribes, both dolicocephalic (like the Malays) and brachycephalic (like the Mongolians). It is, therefore, extremely

difficult to trace any pure race characters, as is evident from the conflicting statements of ethnologists.

It seems to me that this people, the Negrito of Dr. Charles Pickering (1848), and by him, and, after him, by Semper and Müller, classed as Papuans, — or, as Wallace maintains, of Asiatic origin, like the Andaman-islanders, — must be regarded as essentially Papuans, — Asiatic Papuans, if you please; that is, a mixture of this race with the Polynesians, like the Fijians and most of the Pacific-islanders, as distinguished from the present inhabitants of New Guinea.



NEGritos OF LUZON.

And this, I think, is warranted, whether we judge by the shape of the skull, the color of the skin, or the character of the hair. If originally Papuans, they have by persecution retrograded, until now the evolutionist may find in them the nearest approach to Darwin's 'missing link.' The Negrito, in his village, is not far above such an ape as might have been the ancestor of man, with the cerebral convolutions of the orang, the skull of the chimpanzee, the limbs of the gorilla, and

the chest of the gibbon — except that he can make a fire, and cook his food. There is the skeleton of a female in the Paris 'Jardin des plantes.'

SAMUEL KNEELAND.

THE AMERICAN EXHIBIT AT THE LONDON FISHERIES EXHIBITION.

The opening of the great international fisheries exhibition in London brings into view some of the numerous advances which have been made by our own commission in the investigation of the fisheries of the United States. In 1880, at Berlin, the extent of its researches and the importance of its achievements, indicated by the collections which were there displayed, were deeply impressed upon the representatives of other nations, and won for it the highest meed of honor. During the three years which have since elapsed, the activity of the commission has suffered no decline; and the display now made in London is undoubtedly superior in most respects to that made at the previous exhibition. It is impossible in this place to call attention to more than a few of the salient features of the American section of the exhibition.

The preliminary catalogue opens with a classified list of the aquatic animals and plants of North America, beneficial or injurious to man. Among the mammals, we note the group of fur-seals, procured some years ago through the efforts of the Alaska commercial company, and mounted with great care, and much fidelity to nature. The group is accompanied by a series of sketches by Mr. Henry W. Elliott, illustrating the fishery. A stuffed specimen of the rare ribbon-seal (*Histiophoca equestris*) from Alaska, and a skull of the Rhytina, are also included here. A remarkable pair of walrus-tusks, each 41 inches long and weighing about 12½ pounds, loaned by the Alaska commercial company, are exhibited in this connection. The cetacean fauna of North America is well represented by casts and skulls. The aquatic fish-eating birds, including those used by the fishermen for bait, are represented by groups of mounted specimens. The staining of the feet and bills in natural colors, a feature not hitherto introduced into the taxidermy of the national collections, gives a decidedly life-like air to these groups. Most interesting among the reptiles and batrachians, perhaps, are a large leather-back turtle (*Dermatochelys coriacea*) and a collection of twenty-four species of tailed batrachians (*Siren*, *Necturus*, *Siredon*, etc.). The exhibit of fishes is, as may be expected, very comprehensive. The alco-

holic collection, selected with great care by Dr. Bean, includes over four hundred species. More than one hundred especially characteristic American fishes are represented by painted casts of a very high grade of workmanship. A series of photographs from fresh specimens, and another of engravings, both made under the direct supervision of the ichthyologists of the commission, are of especial interest to the zoölogist. During the exhibition, shipments of fresh fish will be sent to London daily by Mr. E. G. Blackford of New York. In the collection of mollusks the American oyster occupies a prominent place. By means of engravings, diagrams, and shells, the result of the latest researches upon its development, growth, and geographical distribution, are fully shown. The models of a giant squid (*Architeuthis princeps*) and of a giant octopus (*Octopus punctatus*) prepared under the direction of Mr. J. H. Emerton, have already been described in an earlier number of SCIENCE. A large series of other invertebrates — crustaceans, worms, echinoderms, and sponges — has been prepared by Mr. Richard Rathbun. Among the most interesting are a complete collection of the species of fresh-water crayfishes found in the United States, and a series of sponges illustrating artificial propagation by cuttings. The Algae of the United States are represented by a collection of marine forms by Professor Farlow, and a series of proofs of the plates of Wood's Fresh-water Algae.

The second section of the catalogue treats of the fishing-grounds, and the distribution of aquatic animals. The models and maps here included are the fruit of a vast amount of toil, and are of high scientific value. Each is worthy of detailed examination. The relief-models of the Atlantic coast and of the offshore fishing-banks have been alluded to in a previous number of SCIENCE. Among the most interesting maps may be mentioned those showing the location and extent of the present and of abandoned whaling-grounds, by Mr. A. Howard Clark; the distribution of the pinnipeds, by Mr. J. A. Allen; the distribution of the seals and other fur-bearing animals of Alaska, by Capt. William H. Dall; the distribution of certain American fishes, by Mr. G. Brown Goode; and the location and extent of the oyster-beds of the United States, by Lieut. F. Winslow.

The third and fourth sections, which are devoted to fishery apparatus, would be almost solely interesting from a technological point of view, were it not for the numerous speci-

mens of Indian and Eskimo fishery implements which they include. The latter collection, which attracted much attention among the German anthropologists in 1880, has received many important additions through the explorations of Messrs. Dall, Bean, and Nelson, in Alaska.

Section E, which relates to the fishermen themselves, contains at least one collection interesting to the ethnologist. It illustrates the *cultus* of the American fisherman. Here are shown the games he plays, the books he reads, the products of the arts he affects, and the musical instruments upon which he performs. In another place is shown a series of large photographs from life, of fishermen of different nationalities employed in the fisheries of the United States.

The collection of biological works in the section devoted to literature forms an epitome of the development of the study of aquatic life in America. The writings of the earlier biologists — the elder Agassiz, Holbrook, Storer, Girard, Stimpson, and many others — are displayed; and in the list of special contributors are the names of Agassiz, Goode, Faxon, Dall, Jordan, Farlow, Ryder, Bean, Verrill, Lockington, and of many other prominent American biologists of the present day. It is much to be hoped that these volumes of papers, which have been gotten together with much labor both by the authors and the commission, may find their way, at the close of the exhibit, to the library of the commission or of the national museum.

Apparatus for scientific investigation of the waters is displayed not only by the fish commission, but by the coast-survey and signal-bureau as well. The latest improvements in sounding and dredging apparatus are represented, and the newest devices in barometers, thermometers, and other similar instruments. Among these are Professor Hilgard's recently invented densimeter and salinometer, Lieut. Tanner's deep-sea sounding-machine, Mr. Benedict's rake-dredge for annelids, and numerous others, many of which form part of the equipment of the fish-commission steamer *Albatross*.

In the manifold forms of apparatus for hatching fishes, the far-seeing zoölogist will see something more than machines for increasing the supply of food-fishes. Important though they be in that connection, they will appear in a new light as delicate instruments for embryological and physiological research, when a greater number of our ichthyologists shall have turned their attention from the taxonomy to the natural history of fishes.

We have not space to dwell upon the collections representing the various products of the fisheries; but there is much in the elaborate display of fish and fertilizers, of glues and oils, of leathers and furs and sponges, and the innumerable commodities which form the harvest of the seas, to attract the attention, and busy the thought, of the political economist and business-man.

It is too soon to say what rank the American division may attain in the exhibition; but one may be safe in remarking that there is no country in the world in which any of the great explorative industries have been subjected to a more thorough investigation from both a scientific and economic point of view than the fisheries of the United States are now undergoing at the hands of the national fishery commission.

NOTE RELATING TO A PECULIARITY DISTINGUISHING ANNEALED FROM UNANNEALED IRON.

THE writer has had occasion recently to study the effect of prolonged stress upon the various materials in common use in the arts, and, among others, upon the finer qualities of iron. The well-known experiment of Vicat, made a half-century ago, had never, so far as the writer was aware, been repeated. The extreme importance of the results obtained by him had apparently not been realized by either physicists or engineers; and it seemed advisable that the experiment be repeated, and, should the results obtained by Vicat be again reached, that the attention of both scientific and practical men should be again called to the subject. The repetition of Vicat's experiment has not only confirmed his conclusion, but has led to the discovery of a new and important, as well as peculiarly interesting, difference in the effect of prolonged stress upon annealed and unannealed iron.

In the autumn of the year 1881, the writer procured two lots of the best Swedish iron wire from Mr. William Hewitt, the vice-president of the Trenton iron and steel works, who very kindly had the wire drawn for the purpose. This wire was divided into two parts, one being carefully annealed, the other being left hard-drawn as it came from the blocks. These were tested in the usual way, and it was found that the hard wire had about double the strength of the soft. Nine pieces were taken from each reel for test, under prolonged static stress, and were suspended from hooks, in the study of the writer, attached to springs,

in order that the effect of jar should not enter into the experiment. They were then loaded with, respectively, in each set, 95, 90, 85, 80, 75, 70, 65, 60, 55, per cent of the average ultimate strength, as already determined. This was done in November, 1881. Since that date, a number have broken, as follows:—

Effect of prolonged stress.—Swedish iron wire.

Per cent max. static load.	TIME UNDER STRESS.	
	Hard wire (unannealed).	Soft (annealed).
95	80 days.	3 minutes.
90	35 days.	5 minutes.
85	17 months, unbroken.	1 day.
80	91 days.	266 days.
75	Unbroken.	17 "
70	"	455 "
65	"	455 "
60	"	Unbroken.
55	"	"

Thus, wire loaded with but 65 per cent of the breaking-load, as usually determined, broke after being subjected to stress for a period of fifteen months, when annealed; while hard wire carrying 85 per cent of the maximum temporary load remains unbroken after seventeen months. It is seen that these results are the same in kind as those obtained by Vicat, and confirm the conclusion that heavily loaded iron, as well as other metals and the woods, are likely to yield ultimately under loads that are sustained for short periods of time without apparent injury. This fact has been amply proven by earlier investigators, as well as by the writer; but the difference above observed, between hard and soft iron, has, so far as the writer has been able to learn, never, until now, been discovered.

Although the experiments of which this is the first are not yet concluded, this discovery, if such it prove, has seemed to be of sufficient importance to justify this note.

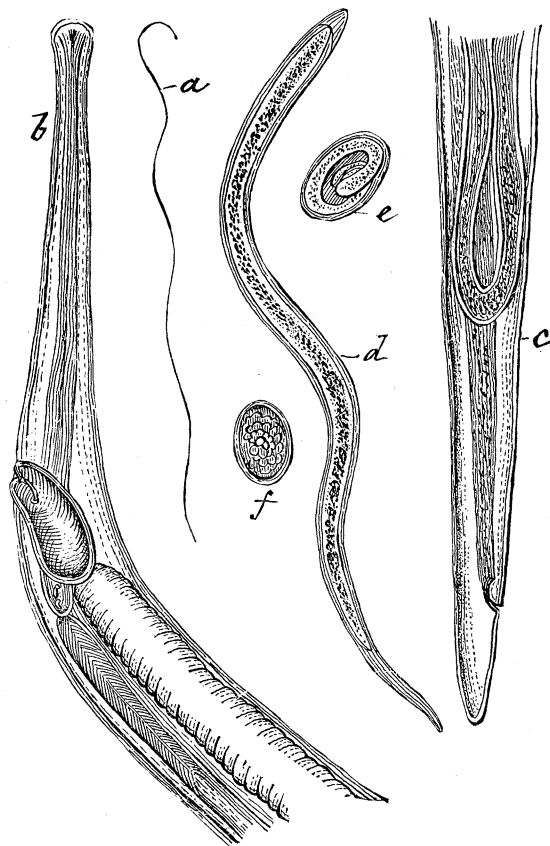
R. H. THURSTON.

Hoboken, N.J., April 22, 1883.

ELEPHANTIASIS, OR FILARIA DISEASE.

DR. A. F. A. KING, dean of the faculty of the National medical college, has recently cited a number of curious coincidences between the habits of the mosquito and the observed phenomena respecting malaria. There are, however, fatal objections to any theory that would connect the two; the coincidences rather indicating that the germs of both develop in similar places. The connection of the mosquito as an intermediary host in the full life-development of the haematozoön, *Filaria*

sanguinis-hominis, however, has been very fully and conclusively made out by Dr. Patrick Manson, of Amoy, China, in the Customs medical reports, published in Shanghai by the order of the inspector-general of customs. Dr. Manson discovered the parent *Filaria* in the mosquito in 1878, and has since published several admirable articles, giving the results of his experiments; which, in the main,



FILARIA BANCROFTI.

a, female (nat. size); *b*, head and neck ($\times 55$ diam.); *c*, tail; *d*, free embryo ($\times 400$ diam.); *e*, egg containing an embryo; *f*, egg, with mulberry cleavage of the yolk ($\times 360$ diam.)—After Cobbold.)

have been independently confirmed by Dr. Mackenzie of the London pathological society, Mr. T. R. Lewis in India, Dr. W. W. Myers, Drs. T. S. Cobbold, Wucherer, Bancroft, Araujo, and others. The facts have an entomological bearing, and are of great scientific interest and practical importance. They may be briefly stated as follows:—

In 1872 Dr. T. R. Lewis first announced the discovery of the immature or larval haematozoön, to which he gave the above trinomial

term, in the blood and urine of persons afflicted with chyluria. The mature form was first described by Cobbold as *Filaria Bancrofti*, in 1877 (*London lancet*, Oct. 6, 1877). As found in the lymph, the parent *Filaria* emits her young in the lymph-stream. The young *Filaria* is an elongate, transparent, very active creature, measuring $\frac{1}{30}'' \times \frac{1}{3500}''$. It makes its way from the lymph to the blood, where, however, it seems to undergo no growth or development. In this its new-born state it is enclosed in a delicate, transparent, and rather loose tunic or cyst, and is found in the blood of patients affected with elephantiasis, but only during the night. This disease is manifest in a thick, livid, tuberculate, and insensible condition of the skin, akin to leprosy. It is endemic over the more thickly populated and tropical portions of the globe, and, in its various forms, is very painful, resulting in deformity, and not infrequently in death. The best authorities now believe that various diseases of the lymphatic vessels and glands—as varicose groin glands, lymph scrotum, elephantiasis, and chyluria—are pathologically one and the same, and are due to the presence of this *Filaria*, which has, in fact, been recorded from South Europe, Asia, Australia, and Brazil; Dr. Araujo having verified at Bahia its occurrence in the mosquito, and otherwise confirmed the observations of Manson and others in different parts of the world.

Before the young *Filariæ* can undergo their full development, they must first enter the body of the female mosquito (*Culex mosquito*), which sucks them up in her nocturnal attacks. Within the mosquito they develop in from five to six days, and upon the death of their host, or before, pass into water frequented by the mosquito for purposes of oviposition, and are thus returned, by drinking, to the human stomach, from which they make their way into some lymphatic vessel, where, the sexes meeting, the female remains, perhaps, for years, giving birth to active young.

In the Customs medical report for the half-year ending March 31, 1882, lately published, and but recently received in this country, Dr. Manson gives the results of some later observations which are full of interest. It seems that the periodicity in the *Filaria* disease has no connection either with temperature, atmospheric pressure, or light, but must be looked upon as an adaptation of the habits of the parasite to those of the mosquito. The conditions for the ingress of the *Filariæ* into the circulation appear to be developed ordinarily during the last few hours of the waking state,

and the parasites are eliminated during the last few hours of sleep. Under ordinary conditions of sleeping or waking, the embryos enter the circulation every evening, increase until midnight, and diminish as morning approaches, until they entirely disappear, and are not found from nine A.M. to six P.M. This periodicity of the parasite is independent of parturition in the parent, as reproduction is continued during the twenty-four hours.

The importance of thus tracing to their true source diseases whose origin has long been involved in mystery cannot be overestimated; and these facts would seem to give additional reasons for the filtering of drinking-water, and the use of mosquito-bars, in all tropical countries. Dr. Manson suggests that the facts ascertained in this connection may lead to a possible future explanation of the diurnal intermission and remission of fevers of the ague class. The most interesting conclusions that have been forced upon Dr. Manson are, that the presence of the parasite in the human body does not always or necessarily produce disease; and that, when disease is produced, it is by exceptional oviparous reproduction instead of the ordinary viviparous mode.

We give his conclusions in his own words:—

“In the instances in which the parent worm has been discovered, she was found in lymphatic vessels on the distal side of the glands. This has been shown to be in many if not in all cases her normal habitat. Her progeny, therefore, must travel along the afferent vessels, through the glands, and so on to the thoracic duct, and thence into the blood. The long, sinuous, and powerful body of the embryo is well adapted to perform this journey. But suppose, instead of this mature embryo, an ovum is launched into the lymph-stream prematurely, and before the contained embryo has sufficiently extended its chorion, then this passive ovum must certainly be arrested at the first lymphatic gland to which it is carried by the advancing lymph-current. It measures $\frac{1}{750}'' \times \frac{1}{3000}''$, whereas the outstretched embryo is only about $\frac{1}{3000}''$ in diameter. It is much too large to pass the glands; and the embryo, rolled up in its chorionic envelope, cannot aid itself. It becomes, in fact, an embolus. Now, *Filariæ* are prodigiously prolific. Myriads of young are expelled in a very short time. I have watched the process of parturition in the minute *Filaria corvi torquati*. Every few seconds a peristaltic contraction, beginning low down in the uterine horns, and extending to the vagina, expels some twenty or thirty embryos. If this process of parturition occurs prematurely, or peristalsis is too vigorous, and extends to a point high up in the uterine horns, where the embryo has not yet completely stretched its chorionic envelope, then ova are expelled. These, as they reach the glands, where the afferent lymphatic breaks up into fine capillary vessels, act as emboli, and plug up the lymph-channels, one after another, until the fluid that carries them can no longer pass. In this way the gland or glands directly connected with the lymphatic in which the aborting female is lodged are thoroughly obstructed. Anastomoses for

a time will aid the passage of lymph; but the anastomosing vessels will carry the embolic ova as well as the lymph. The corresponding glands will then, in their turn, be invaded; and so on, until the entire lymphatic system, connected directly or indirectly with the vessel in which the parent worm is lodged, becomes obstructed.

"This, I believe, is the true pathology of the elephantoid diseases: 1°. Parent *Filaria* in a distal lymphatic; 2°. Premature expulsion of ova; 3°. Embolism of lymphatic glands by ova; 4°. Stasis of lymph; 5°. Regurgitation of lymph, and partial compensation by anastomoses; 6°. Renewed or continued premature expulsion of ova; further embolism of glands. This process, according to the part of the lymphatic system it occurs in, the frequency of its recurrence, and its completeness, explains every variety of elephantoid diseases."

C. V. RILEY.

INTERNAL MOLECULAR ENERGY OF ATOMIC VIBRATION.¹

THE object of this paper is to examine at length the relative amount of energy which a molecule may possess with respect to any small degree of freedom of motion which its atoms may have as to each other. The theorem of the virial is applied to this motion of the atoms; and it is found, that in a molecule of a perfect gas consisting of but two atoms, which are at a mean distance, r , from each other, and which suffer a small displacement whose mean maximum amplitude is δr under the action of elastic forces, the energy of atomic vibration will be to that of translation parallel to any assumed direction in space as δr to r . It is further shown that this result is of such a character as not to be restricted to molecules of two atoms merely, nor to atoms which are attracted toward their mean position by forces varying simply as the first power of the displacement; so that the result arrived at is of a general nature which may be stated thus: the energy of interatomic vibration depends upon the atomic displacement within the molecule, and in such a way, that, when this displacement is a vanishing quantity compared with the dimensions of the molecule, then this energy of internal vibration is a vanishing quantity compared with the energy of motion of the molecule as a whole.

This result is in confirmation of the results obtained by the author in his previous paper upon 'An extension of the theorem of the virial,'² etc., in which he expressed the opinion that the results there obtained led to the conclusion, that "in case partial constraints not amounting to the loss of entire degrees of freedom are introduced, the energy will no longer be equally distributed among the co-ordinates, but will be influenced by their constraints."

This being in direct contradiction to the conclusions which have been deduced by Boltzmann and by Watson from the discussion of the distribution of energy by the method of generalized co-ordinates, an examination is made of the point in this hitherto accepted theory from which the contradiction arises, and an error is pointed out in the method of employing the fundamental expression for the distribution of velocities. The error is of this nature: the law expressing the most probable distribution of velocities with respect to any single co-ordinate is the same as that of the most probable distribution of errors of obser-

vation, and contains a single arbitrary constant, to be determined by the observations themselves. It has been assumed that this constant is the same for each co-ordinate, which is, in effect, assuming the very point to be proved. It is here pointed out, that doing this commits an error of the same nature as is done in assigning equal weights to unlike observations without first showing that their weights are equal.

The computations made by means of the virial show conclusively that the mean energy (i.e., the weight) is not at all the same for one degree of freedom as for another; and, in order to find how one is related to another, it will be necessary to take account of the forces acting, as has been done in this paper and in the previous one.

This extension of the theory leads to numerical results in close accordance with observed values of the specific heats of gases, and their ratio, without previous knowledge of these quantities for any gas; thus computing these quantities for the first time solely from the general equations of mechanics.

ON THE DEVELOPMENT OF CHLOROPHYLL AND COLOR GRANULES.

THE view has been generally entertained, based largely on the admirable investigations of Arthur Gris, that chlorophyll-granules are produced by direct differentiation of the protoplasm of assimilating cells. Led by his study of certain protoplasmic bodies in the cells where nutritive matters are stored for future use, and following out a suggestion made by Schmitz in his recent work relative to the assimilating bodies in certain Algae, A. F. W. Schimper (*Botan. zeit.*, Feb. and March, 1883) has made a detailed examination of the origin of chlorophyll-granules, which indicates that the views of Gris are erroneous. At the points of growth examined by him, Schimper uniformly found that well-formed granules already exist, and that, from subsequent division of these, all the chlorophyll-granules are produced. From these, and not, as heretofore believed, from the differentiation of the protoplasmic mass in the cell, arise the granules which later, under the influence of light, take on their characteristic color. One of the most interesting cases reported by him is that of *Azolla*. The point of growth at the root contains bright green chlorophyll-granules about as large as those in the older parts, and in these granules the process of division is to be distinctly traced.

In those points of growth where the tissues are as yet free from color, he has been also able to follow the division, step by step, up to the production of complete green granules. The bodies from which the granules are produced are present, likewise, in all points of growth of seedlings. Just here is found the most interesting feature of this investigation. From these bodies, which he well terms 'plastides,' come three classes of protoplasmic bodies, somewhat resembling one another in shape: namely, 1, the chlorophyll-granules, or *chloroplastides*; 2, the starch-formers, which, with the allied white or colorless bodies, he calls *leucoplastides*; and 3, the bodies which possess colors other than green (for instance, the granules in petals and the like), to which he gives the name *chromoplastides*. To illustrate this from a single case, we will allude to *Impatiens parviflora*. The very transparent cells at the point of growth contain plainly visible leucoplastides. In cells of the same age they are of the same size, often constricted, always sharply defined. These can be traced by plain transitions into chloroplastides on the young stem and the zone of forming leaves,

¹ Abstract of a paper upon a further extension of the theorem of the virial to the internal molecular energy of atomic vibration. By H. T. EDDY, Ph.D., Cincinnati. Read before the Section in physics and chemistry of the Ohio mech. Inst. April 26, 1883.

² *Sc. proc. Ohio mech. inst.*, March, 1883; *SCIENCE*, p. 65.

while, at the point of growth in the root, only leucoplastides are to be seen. Moreover, in following the plastides farther back, he found them present in the seed itself; and this he conjoins with the well-known fact, that chlorophyll-granules are to be found ready formed in certain seeds.

The destiny of the plastide depends upon the tissue which is to be developed from the meristem. Some of them remain colorless, that is, as leucoplastides, and serve to produce starch-grains at the expense of assimilated matters; others become chloroplastides to produce assimilated matter; while still others are to furnish colors to flowers and fruits. This simplest of all organs is therefore capable of wide metamorphosis, by which it becomes fitted for its diverse functions.

Nor is this all. The same plastide can become at different stages of its life a leuco-, a chloro-, and a chromo-plastide. But which of these is the primal form? To this the author answers unequivocally, the chloroplastide; and he believes that the others have all been derived therefrom. Reserving some of the other features of this suggestive paper for another notice, it may be said that the terms proposed by Schimper are quite equivalent to those given by Van Tieghem in his Botany, now in course of publication, as *leucites* and *chloroleucites*, and, in part, to his *xantho-leucites*; but, so far as their development is concerned, the latter author follows the accepted view of Gris. G. L. GOODALE.

LETTERS TO THE EDITOR.

Molluscan rock-boring.

IN giving lectures upon building-stones my attention has been often called to the action upon them of boring mollusks, echini, annelids, sponges, etc., when used in submarine constructions.

In Albany Hancock's paper on the above subject (*Ann. mag. nat. hist.*, (2), ii. 225, pl. viii.), are figured numerous siliceous grains, found about the foot and mantle, which he regarded as secreted by the mollusk, and employed in excavating the burrow. While Hancock's conclusions are generally denied, I have not seen any explanation of the observed particles. The forms figured by him, especially in fig. 6, resemble the grains (principally quartz) observed in the microscopic study of mud and other earthy deposits. Such grains would naturally be the result and not the cause of the rock excavation; and it is difficult to see how the animal could be in the position in which it is found, without their presence about it.

Perhaps some zoölogist can state if this explanation has been given before, and whether it be correct or not. M. E. WADSWORTH.

Cambridge, Mass., April 30, 1883.

The Lake Superior rocks.

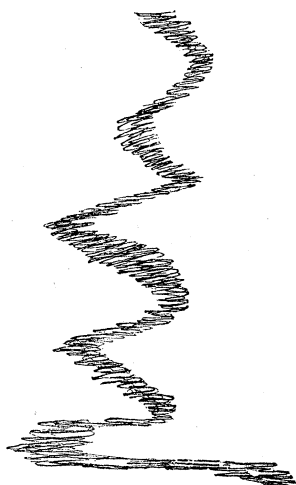
Prof. N. H. Winchell is evidently right in saying, in *SCIENCE*, No. 12, that, in my letter in No. 5, I misrepresented his position on the unconformity in the St. Croix valley. I had said that he had strenuously denied this unconformity, because my recollection of a conversation on the subject, held with him in 1880, was to that effect. But, on turning to the reference he gives in his First annual report of the geological survey of Minnesota, I see that he had announced such an unconformity as long ago as 1872, which, of course, I should have known before; so that I must have misunderstood him.

As to the other matter, — viz., the relation of the 'St. Croix' or Potsdam sandstone of the Mississippi valley to the 'eastern sandstone' of Lake Superior, — I certainly have understood from his various reports,

that he regarded them as distinct. But I am very glad to be set right on these points, though regretting very much having misunderstood Professor Winchell; for it narrows down the question at issue between us very materially. R. D. IRVING.

Track of meteor.

In your first number, Feb. 9, 1883, I saw an account of a meteor witnessed by Capt. Belknap of the U. S. S. Alaska, Dec. 15, 1882, and reference to a similar phenomenon seen at Lake Winnipeg June 29,



1860. On the evening of June 17, 1873, in early twilight, and before any stars were visible, upon coming out of my hotel in Vienna, I found a crowd of persons watching a similar phenomenon, which appeared to be just north of the Kahlenberg. Upon inquiry, I learned that a meteor had been seen to fall a few moments before, but without noise; and a subsequent watch of the daily papers gave no account of any meteorite, which could hardly have escaped observation in this settled section of Austria. It would appear, therefore, that

this meteor must have been entirely dissipated in vapor before reaching the earth.

When I first saw the luminous track, I at once supposed it, from appearance and color, to be the flame from a distant zinc-furnace; but it was gradually changed from its straight course to a curved line closely resembling fig. 3 in *SCIENCE*, No. 1, p. 5, and appeared to be borne to and fro by the gentle currents of air. It extended fully 30° from the horizon, and was distinctly visible for half an hour after my attention was first called to it. From a letter sent by me the next day to a friend in this country, the above facts are taken, in which letter I roughly sketched the appearance of the luminous cloud, after a few minutes from the fall of the meteor, as shown by the accompanying cut. PETER COLLIER.

AUGUSTUS DE MORGAN.

Memoir of Augustus de Morgan; with selections from his letters. By his wife, SOPHIA ELIZABETH DE MORGAN. London, Longmans, Green, & Co., 1882. 10, 422 p., portr. 8°.

IF the degree of interest which attaches to the life of a hard-working mathematician is, from the nature of the case, less than strong; if the biography of De Morgan is in this respect in marked contrast to that of a man whose life is a picture of his time, and who has had himself a distinct effect upon his time, — to the life, say, of Harriet Martineau, which was included within nearly the same years as the life before us, — it is none the less true

that the record of an eminent scientific man, his nature and his nurture, and his way of regarding the important questions of his day, is material which one would not willingly have lost. The present memoir disclaims being written from a scientific point of view; and it does not, in fact, furnish ground for modifying the very just estimate of De Morgan which is given by Mr. Jevons in the *Encyclopaedia Britannica*. Nor is it, on the other hand, a very personal memoir. The letters are nearly all addressed to scientific friends, and are on questions of general interest. His correspondence with his wife and children, from whom he was seldom separated, was fragmentary, and not suited for publication; and, with respect to domestic details, his biographer has done what she knew her husband himself would have wished. He was always averse to making known what nearly concerned his family.

De Morgan was born in the year 1806, at Madura, in the Madras presidency. His father, Col. John De Morgan, was in the service of the East India Company; and both his grandfather and his great-grandfather had served under Warren Hastings. His mathematical powers, as well as his taste for music, he derived from his mother, who was the granddaughter of James Dodson, author of the *anti-logarithmic canon*, a friend of De Moivre, and an early fellow of the Royal society. Soon after De Morgan's birth, the family returned to England, and settled first at Worcester. The young Augustus was indoctrinated in various branches of 'general knowledge' in many different private schools, after having learned reading and numeration from his father at the age of four years. His estimate of the character of the instruction which he received appears, from his belief in after years, that, of exceptional children, those who are least taught have the best chance of a healthy development. One element of his early teaching — the formal observances and the rigid religious doctrines in which he was trained — strongly tinged his character in after life. He was made to learn by heart long passages of Scripture, which, from frequent repetition, had become meaningless to him; he was taken to church twice in the week and three times on Sundays, and required to give an abstract of every sermon he heard, until church became a place of penance to him, and Sunday the one wretched day of the week. In after years he was unable to listen for any length of time to speaking or preaching: to get rid of memories of dreary sermons, he had to think of something different from what was being said.

Until after the age of fourteen, he had shown rather less than the usual aptitude for mathematics. He said one day to an old gentleman, a friend of the family, who saw him making with great care a figure with ruler and compasses, that he was 'drawing mathematics.' From him the future mathematician learned, greatly to his surprise, that he had hitherto missed the aim of Euclid, and that geometry does not consist in drawing accurate figures; and he was soon intent upon the first demonstration of which he ever understood the meaning. From that time his progress was rapid. At the age of sixteen he entered Trinity college, Cambridge; and in his second year his tutor writes, "He is not only in our first class, but far, very far, the first in it." Airy, Peacock, and Whewell were among the teachers whose instruction he particularly prized, and with whom he kept up a life-long friendship and correspondence. In 1827 he took the degree of fourth wrangler only, his wide mathematical reading having led him too often far away from the courses prescribed for examination; and to the bitter disappointment of his mother, who had hoped to see her oldest surviving son in the church, he came up to London soon afterwards, and entered at Lincoln's Inn. In London he made the acquaintance of William Frend, whom he describes as a man of singular directness and clearness of mind, a clergyman of the church of England, and a member of the old Mathematical society, who rejected negative quantities and the doctrine of the Trinity. In his house he became a frequent guest; and his children were surprised to find that this brilliant young man, of whom great things were expected in science, rivalled them in love of fun and fairy-tales and ghost-stories, and that he could even show them a new figure in cat's-cradle. It does not appear why so auspicious a beginning did not result in his marriage to Sophia Elizabeth Frend until ten years later.

The two great universities were closed to De Morgan on account of his strong repugnance to sectarian restraints on freedom of opinion; and hence he welcomed the opening of University college (called at first the London university), not only as meeting a great want of the time, but as offering to himself a prospect of leaving the study of law for a more congenial occupation. Out of thirty-two candidates, he was unanimously elected to the chair of mathematics, in spite of his being only twenty-one years of age. Three years later he handed in his resignation. The professor of anatomy had been removed on account of some complaints preferred against him by his class; and De

Morgan immediately addressed a letter to the council, saying that he considered it discreditable to hold a professorship one moment longer in a college in which a professor might be removed and disgraced without any fault on his part. His resignation was accepted; but, after five years of private teaching and voluminous writing, he returned to his university. The sudden death of his successor at the end of a summer vacation induced him to offer to fill the vacancy until Christmas; and his belief, that, owing to changes in the management, his former objections to holding office would not recur, led him to accede to the request of the council that he should permanently resume his chair.

De Morgan's life is chiefly a record of his labors and his publications. He gave regularly twelve lectures every week, besides occasional extra courses; and for half an hour after each lecture he remained in his place to give personal assistance to those students who needed it. This, with an hour for correcting exercises, made four hours of solid work for each day in the week, without counting the time required for preparation. As a lecturer, he showed unrivalled skill. Mr. Sedley Taylor writes, "His exposition combined excellences of the most varied kinds. It was clear, vivid, and succinct; rich, too, with abundance of illustration, always at the command of enormously wide reading and an astonishingly retentive memory. A voice of sonorous sweetness, a grand forehead, and a profile of classic beauty, intensified the impression of power . . . which he made upon his auditors." He had a great hatred of cram, and no confidence in the power of an examination to determine the true value of a student's knowledge. "The claims which college examinations might be supposed to have on the studies of his pupils were never allowed to influence his programme in the slightest degree." He wrote the following in illustration of a Cambridge examination:—

Q. — What is knowledge?

A. — A thing to be examined in.

Q. — What must those do who would show knowledge?

A. — Get up subjects, and write them out.

Q. — What is getting up a subject?

A. — Learning to write it out.

Q. — What is writing out a subject?

A. — Showing that you have got it up.

The list of De Morgan's publications is a very long one. Much of his writing was of a kind which it is extremely useful to have done at the time and to have well done, but which is not destined to be preserved, and which it is

more economical to extract from a man of less than De Morgan's ability. He wrote one-sixth of the Penny cyclopaedia, and he made voluminous contributions to the Journal of education, the British almanac and companion, the Dublin review, Notes and queries, the Athenaeum, the insurance journals, and to the memoirs and obituary notices of the Astronomical society, in whose affairs he took an active part for thirty years. His most important contributions to science are his papers on the Foundations of algebra and on the Syllogism, his text-books on Formal logic and on the Calculus, and his treatises in the Encyclopaedia metropolitana on the Calculus of functions and the Theory of probabilities.

Such an amount of labor left very little time for pleasure or relaxation; and, in fact, De Morgan writes near the end of his life, "I have never been hard working, but I have been very continuously at work. I have never sought relaxation. And why? Because it would have killed me. Amusement is real hard work to me." He had, however, an interesting circle of friends, who came frequently to his house, and in whose society he found great pleasure. Libri (the author of the History of mathematics), Arthur Hugh Clough, Miss Muloch, and Mrs. Follen the abolitionist, were among them. Throughout his life, also, he was an inveterate reader of novels, good and bad. Puzzles, and even puns, were interesting to him. He made a collection of over eight hundred anagrams on his own name; and his fondness for paradox was so well known that the circle-squarers all sent him their most curious investigations. He was a thorough believer in the phenomena called spiritual. After describing some striking occurrences in spirit-rapping, he writes, "I was perfectly satisfied that some thing, or some body, or some spirit, was reading *my thoughts*;" and in regard to mesmerism, "Of the curative powers of this agent I have no more doubt than one has of things which he has constantly seen for years." His feelings on the subject of slavery were very intense, and he sat up the greater part of one night to finish Uncle Tom's cabin.

De Morgan presents another instance of the fact that a man's views of women in general are seldom dissociated from the result of his observations upon the few women who stand nearest to him. His clever wife had the effect of dispelling the prejudices with which his rather narrow-minded mother had inspired him. She writes, "I must not conceal the fact, that, in the earlier part of his life, he held man-

like and masterful views of women's powers and privileges. Women, he thought, ought to have every thing provided for them, and every trouble taken off their hands: so the less they meddled with business in any form, the better. But these very young notions gave way, as he saw more of life, to wiser and more practical ones. He found that women were not utterly helpless; and his love of justice, combined with his better opinion of their powers, made him quite willing to concede to them as much as he would have desired for himself; namely, full scope and opportunity for the exercise of all their faculties. This was shown by his giving lectures gratuitously in the Ladies' college for the first year after its foundation, and by the interest he felt in the success of those brave women who first attempted the study of medicine."

De Morgan's letters are of a kind which it is very interesting to receive at the natural intervals at which they are written. When taken *en masse*, the logico-mathematical language in which they are couched, amusing in small doses, and their wit, excellent but monotonous, become wearisome. It is too much like sitting down to a continuous reading of the Budget of paradoxes.

In regard to his ideas on religion, De Morgan was always extremely reticent; but in spite of the disastrous effect of his early training, and in spite of his strong aversion to unfounded beliefs, he preserved a deeply religious tone of mind, and a firm faith in the Christian religion. At the same time, nothing could be more frank and uncompromising than the way in which he meets the renewed insistence of his mother, upon the occasion of the death of a sister to whom he was much attached, that he should renounce his freedom of opinion. His letter, if somewhat severe and untender, is still a splendid example of that strong rectitude of mind which was characteristic of him, and which did not permit him to gain any thing, even family harmony, at the cost of concealment.

The last years of De Morgan's life were years of disappointment and grief. The university in which he had labored with untiring energy until the age of sixty became once more impossible to him. The reiterated pledges of its founders and subsequent directors, that the essence of its being should be absolute and complete religious equality in every portion of its organization, were broken; and De Morgan could not lend his countenance to a less liberal or a more worldly line of policy. Upon the refusal of the council to appoint to the

chair of mental philosophy and logic the Rev. James Martineau, who had been recommended by the senate on account of his wide reputation as a preacher of an unpopular sect, De Morgan once more handed in his resignation. A year later occurred the death of his second son, George, a young man of great mathematical promise, and one of the two first projectors of the present Mathematical society. From this time De Morgan's health and vigor were not what they had been; and after an attack of congestion of the brain, from which his recovery was slow, he died in 1871 of nervous prostration.

WHITE'S FOSSIL MOLLUSKS OF NORTH AMERICA.

A review of the non-marine fossil Mollusca of North America. By C. A. WHITE. Washington, Government printing-office, 1883. 1, 144, 3 p., 32 pl. sm. 8°. [Annual report U. S. geological survey, 1881-82, separately pagged.]

No work is more useful to the biologist, whether his studies relate to recent or to fossil forms, than the collection and careful illustration of scattered material. In the book under consideration, Dr. White has produced for the student of mollusks, in either their recent or their paleontological relations, a much-needed and permanently valuable work of reference. Owing to their wide range, fecundity and accessibility, the class of mollusks included under his title are, all over the world, better known, more thoroughly studied, and more easily collected, than those of the sea. Hence it is to be expected that the material for learning what lessons they have to teach will be available for students much sooner with the land and freshwater mollusks than with the marine species considered as a class. Publications such as this, perhaps more than any other single means, will serve to shorten the time which must elapse before such a condition of the science is reached. Stratigraphical paleontology will not be so much the gainer as biology in a wider sense, since the uniformity of lacustrine and fluvial conditions interferes with that differentiation which makes of some groups of marine mollusks valuable indices of geological time.

Dr. White has brought together excellent figures of nearly all the species of the groups under consideration belonging to North American paleontology, from the oldest strata in which they are known, to and including the miocene tertiary. One doubtfully pliocene species is mentioned; but the fossils of the later marls, and such deposits as that of the Colorado

desert, are not considered. Most of these are known as recent shells also; but we think it would have been a useful addition to the collection if such extinct forms as *Tryonia* had been included.

To the catalogue in tabular form and the explanation of the plates are prefixed a statement of the object and method of the work, a *résumé* of the subject by zoological families, and some general considerations. In these last the author, we think, is the first to enunciate certain propositions, which, though simple, constitute an important advance over previous statements of the general topic. In brief, he points out the high probability that lacustrine, at first brackish-water forms, were derived from marine species by imprisonment due to rising seashores, forming, first estuaries, then lakes; afterward differentiated so as to become inured to water without salt, or, in other cases, exterminated by water too fresh, or in lakes without an outlet, by concentration of saline matters. This view is not wholly novel; but the author goes on to supplement it by pointing out how, from the gradual conversion of lakes into rivers, and the persistence of the latter through epochs of geological change, the remarkable persistency of fluviatile types is accounted for, and problems of present geographical distribution may be solved.

Too much space would be required for an analysis of the work in detail: a few points have been noted for mention. It seems a little startling to have oysters, *Anomia*, and mussels presented as non-marine, until we learn that they were of the peculiar brackish-water beds in the Laramie group, and were doubtless accustomed to almost lacustrine conditions. The oldest forms treated of are *Naiadites* and certain supposed *Anodontae* from the Devonian (the latter much suggesting in appearance *Lithodomus* and its allies); but if these were not, as is supposed, true fresh-water folk, then the earliest of the latter date from the trias. Six families of *Conchifera*, in all, and sixteen of *Gastropoda*, are represented in the catalogue. It might be suggested that an analogue of *Unio belliplicatus* may, perhaps, be found living in Nicaragua, and that *Cerithidea* lives rather abundantly on the Californian coast.

The proof-reading of this volume is not up to the usual standard of the Government printing-office, and the index is disappointingly meagre. The arrangement of the numbers to figures on the plates is confused and puzzling: it can hardly fail to cause a serious loss of time to those who consult them. On the other hand, the paper and press-work are above the average, and the execution of the figures unusually good.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

GEODESY.

Geodetic night-signals.—Mr. C. O. Boutelle, of the U. S. coast-survey, finds that the magnesium light as used by the survey may be used for distances as great as forty-five to seventy miles, and that the ordinary student-lamp with a parabolic reflector may be seen as far as forty miles. A report on night-signals was published by the coast-survey last year. The advantages stated in the report, as derived from greater steadiness of the atmosphere, and comparative freedom from lateral refraction upon long lines of sight during night observations, have been signally verified during the seasons of 1881 and 1882.—(*Rep. U. S. coast geod. surv.*, 1880.) [859]

MATHEMATICS.

A definite integral.—In a brief note, M. Korkine gives a simple proof of a theorem due to M. Tchébychef. The theorem relates to the integral $\int_0^1 \phi(x) \psi(x) dx$, where ϕ and ψ must satisfy one of the two conditions: 1°, they simultaneously increase or simultaneously decrease for all values of x lying between zero and unity; 2°, or one of them must increase and the other decrease for the same values of x . In the first case, M. Tchébychef's theorem is

$$\int_0^1 \phi(x) \psi(x) dx > \int_0^1 \phi(x) dx \int_0^1 \psi(x) dx;$$

in the second case,

$$\int_0^1 \phi(x) \psi(x) dx < \int_0^1 \phi(x) dx \int_0^1 \psi(x) dx.$$

M. Korkine makes these theorems the immediate consequence of a simple identity.—(*Comptes rendus*, Jan. 29.) T. C. [860]

Linear differential equations.—In a previous communication to the academy, M. Goursat has solved, for a special class of equations, the problem to find the entire number of substitutions to which a system of fundamental integrals of a given equation may be subjected, corresponding to all the different closed paths which the variable may describe. The general integral in that case was shown to be expressed by hypergeometric series of higher orders. In the present paper, M. Goursat develops more fully his method, and applies it to the equation of the third order, remarking that the method followed is identically the same for equations of any order.—(*Comptes rendus*, Jan. 29.) T. C. [861]

Functions of two independent variables.—M. Picard has given a series of notes upon this subject, determining the functions of two independent variables, u and v , which remain invariable when we effect upon u and v any of the infinite number of substitutions of a linear discontinuous group. In the present paper M. Picard considers, in a general

manner, a discontinuous group for all points (u, v) of the region D, defined by

$$u'^2 + u''^2 + v'^2 + v''^2 < 1,$$

where

$$u = u' + iu'', \quad v = v' + iv''.$$

The author shows that every substitution of the group transforms each point of the limit of D into another point of the same limit. He also shows that there exist functions, F , of u and v , only defined in the region D, and which leave invariable all of the substitutions of the group. The only groups considered are those possessing this property: viz., we can always find in the region D a region R, having no point common with the limit of D, and such that, in the interior of R, there is one, and only one, point which corresponds to any point (u, v) by means of the substitutions of the group. — (*Comptes rendus*, Jan. 29.) T. C. [862]

Differential equations. — M. Steen treats certain differential equations of the second order, an account of which has already appeared in another place. The differential equations are of the form

$$y'' - (a \cot x - b \tan x) y' + cy = 0, \\ y' + (a \cot x - b \tan x) y + cy = 0;$$

x being the independent variable, and the accents denoting differential co-efficients. These equations are treated for special values of the constants a, b, c , and the integrals exhibited in the form of series of trigonometric functions, and also in the form of definite integrals of certain trigonometric functions. — (*Vidensk. selsk. skr.*, (6), *naturv. math. afd.*, i. 6.) T. C. [863]

PHYSICS.

Mechanics.

Radius of gyration of a rifled projectile. — Lieut. C. A. Stone deduces a formula for the determination of this value. Applied to the 700-lb. Butler shell, he obtains $K = 4.1224''$; while the bureau of ordnance, U.S.A., found by experiment for this shell, $K = 4.1005358''$. Lieut. Stone discusses, also, the ratio of the forces necessary to give translation and rotation to a rifled projectile, and the ratio of the ranges of a projectile measured on the horizontal and on an inclined plane in a non-resisting medium. — (*Proc. U. S. nav. inst.*, viii. no. 4.) C. E. M. [864]

Acoustics.

Hydrogen-whistles. — Mr. Francis Galton has continued his researches upon the production of notes of excessively high pitch, and their audibility to different animals, wishing to test the powers of insects in this respect. The idea has occurred to him of blowing his high-pitched whistle with hydrogen-gas, and so increasing its shrillness. Preliminary experiments with coal-gas have given good results; and Mr. Galton thinks that he can produce a sound due to 624,000 vibrations per second. — (*Nature*, March 22.) C. R. C. [865]

Intensity of sound. — Vierordt has studied the subject of the estimation of the intensity of sound by the process of dropping a body upon a sonorous plate. The intensity of the sound produced is proportional to h^e , where e is a co-efficient to be determined experimentally. A formula given by Oberbeck is,

$$e = \frac{\log \frac{P}{p}}{\log \frac{H}{h}},$$

if h is the height fallen through by the heavier weight P , and H the greater height fallen through by a

lighter weight p , when the intensity of the sound produced by striking the plate is the same. A large number of measurements are recorded, from which the author concludes that there is a general measure of the strength of sound. With spheres of the same material, and plates of definite material and weight, the value of e varies but slightly with increasing weight of the sphere, or with variation in the height of fall. — (*Ann. phys. chem.*, No. 3, 1883.) C. R. C. [866]

Optics.

(Photography.)

Astronomical photography. — At the Meudon (France) observatory they are studying movements of photospheric matter with the aid of series of images obtained with the 'photographic revolver.' They are also working at photographic photometry, the principle being, that the intensities of two light-sources are in the inverse ratio of the time they take for the same photographic work; e.g., producing the same tint on two quite similar plates. The method will be applied to data of the comet of 1881, the full moon, etc. — (*Nature*, March 15.) W. H. P. [867]

Astronomical photography. — At the March meeting of the Royal astronomical society, Dr. Gould gave an account of his work at Cordova. He considered that he had been successful in photographing stars down to the tenth and a half or twelfth magnitude. Mr. Common showed a photograph he had taken of the great nebula in Orion, the appearance of which, in many parts, gave rise to an interesting discussion; the majority of those taking part inclining to the belief that the photograph represented certain unknown dark objects in space. — (*Brit. journ. phot.*, March 23.)

[No such appearance has been noted here in the excellent photographs of this object taken by the late Dr. Henry Draper.] — W. H. P. [868]

Positive prints from a positive. — MM. Cros and Vergeraud have sent to the French photographic society a communication on the above subject. A suitable paper is covered with a solution of ammonium bichromate, 2 grams; glucose, 15 grams; water, 100 grams. This is dried, and exposed to the light under a positive. When the uncovered portions of the paper, which were at first of a decided yellow, have become gray, the exposure is discontinued, and a rapid immersion made in a silver bath, composed as follows: silver nitrate, 1 gram; acetic acid, 10 grams; water, 100 grams. The image appears immediately of a blood-red color, formed by the bichromate of silver. In all parts where the light has acted, the bichromate has been reduced by the glucose; and, where the variable opacities of the image have protected in different degrees the sensitive film, the bichromate of silver remains insoluble in the water of the subsequent washing. If dried by fire, the image remains red; if dried in the open air and in the light, especially in the sun, it becomes dark brown. To obtain a black image, it suffices to expose the dry prints to sulphurous-acid gas. A bath of sulphite of copper and potash in solution gives a more intense black. — (*Philad. phot.*, April.) W. H. P. [869]

Electricity.

Electro-optical properties of quartz. — W. C. Röntgen confirms and extends results obtained in a former paper (*Ann. phys. chem.*, no. 3). The specimens used were a thick circular plate, cut perpendicular to the principal axis of the crystal, and a sphere. The apparatus for investigating the quartz-sphere was an old microscope. The quartz was laid on the

object-stand, and the weighted microscope-tube let down upon it. There are three planes through the principal axis, making angles of 120° with each other, such that all pressures in these planes, or parallel to them, produce minimum electricity at the points of pressure. Pressure exerted perpendicular to these minimum planes produces maximum electricity. Each of the six fields into which the minimum planes divide the sphere possesses the property that all points of pressure within it are electrified to the same sign: these signs are opposite in adjacent fields. Pressure in the direction of the principal axis gives each of the six fields its peculiar sign: pressure in any other direction divides the sphere into two oppositely electrified halves, the plane of division passing through the principal axis. No direction of pressure produces electricity at the ends of the principal axis. If the direction of pressure is a maximum axis, the plane of division is the minimum plane perpendicular to it (the signs of the halves correspond to the signs of the fields in which the maximum axis lies); but, if the pressure is in this minimum plane, the electrification is exactly reversed. The experiments seem to show, that, if the direction of pressure rotates about the principal axis with an angular velocity ω , the plane of division rotates in the opposite direction with a velocity 2ω . The author then shows that the optical properties of quartz in an electric field can be accounted for by the expansions and contractions which quartz undergoes under electrical strain, according to the principle of reversibility of piezoelectric effects pointed out by Lippmann. This result has also been reached independently by Kundt in *Ann. phys. chem.*, no. 3. — (*Ann. phys. chem.*, no. 4.) J. T. [870]

Corrosion of steel. — Two chisels in the channel-way of the U.S.S. Triana were badly corroded. Prof. Munroe, U.S. N.A. finds this due to electro-chemical action between tempered and untempered steel in presence of salt water. The untempered steel suffered. — (*Proc. U. S. nav. inst.*, viii. no. 3.) C. E. M. [871]

ENGINEERING.

Tensions in guns. — Considering the longitudinal and hoop tensions in a thick hollow cylinder, Lieut. Stone, U.S.N., finds that the longitudinal tension is greatest on the outside, and the hoop tension is greatest on the inside, where an assumed distance of a point from the axis of the cylinder coincides with the internal radius. He shows the presence of a neutral surface, within which there is a longitudinal compression, and without, a longitudinal tension. The formula deduced, giving the value of the maximum hoop tension, differs considerably from that heretofore used. The existence of a neutral surface of longitudinal stress is of great interest in the construction of built-up guns. That a longitudinal contraction may accompany a circumferential expansion is a familiar result of experiment. These formulas may be used in calculating the tensions in built-up wire guns. — (*Proc. U. S. nav. inst.*, viii. no. 3.) C. E. M. [872]

Lighting buoys and railroad-cars. — The U. S. lighthouse board has placed a Pintsch lighted buoy at the entrance of New-York harbor at the request of the pilot commissioners. The Erie and the West Shore railroads have adopted this method of lighting cars in imitation of German railways. Gas made from coal-oil is stored by compression in reservoirs, and burned in peculiar burners, a regulator being used to preserve the desired pressure. — (*Marine reg.*, *R. R. gaz.*, April.) R. H. T. [873]

Heavy steel guns. — The chief of ordnance has called for information from the steel-makers of the United States, relative to the feasibility of making steel for ordnance, giving analyses of desired qualities. The act of 1883 provides for arming fortifications with steel guns. — (*Bull. iron steel assoc.*, April, 1883.) R. H. T. [874]

Standard gauge system. — G. M. Bond, M.E., has described to the American society of mechanical engineers the system of standardizing gauges devised by Prof. Rogers of Harvard, and himself, for the Pratt & Whitney company of Hartford, and the comparator built for that company under their direction for establishing standard gauge measures. A pair of standard inch-measures, worked down independently, were found to be exactly alike, the difference, if any exists, being less than $\frac{1}{100000}$ inch. Bond reports ready for inspection by the committee of the society, a set of end-measures varying by sixteenths of an inch, and a complete plant of tools and fixtures for producing standards, duplicating originals by machined work. — (*Journ. Frankl. inst.*, May.) R. H. T. [875]

CHEMISTRY.

(Analytical.)

Estimation of sulphur in organic bodies. — P. Claesson has perfected a method for the determination of sulphur in organic substances, which seems, from his results, to be capable of remedying the various defects that detract to a greater or less extent from the accuracy of the methods hitherto in use. It consists in burning the substance in a current of nitric dioxide and oxygen, and absorbing the sulphuric acid in a receiver containing water. The sulphuric acid may be determined by titration, or by precipitation as baric sulphate. The substance is placed in an ordinary combustion-tube, and behind it a roll of platinized asbestos. In front of the substance are placed several platinized asbestos rolls, and a small tube containing fuming nitric acid. The combustion is conducted in the usual way, and finally the sulphuric acid as well as the nitric acid is expelled into the receiver. The author adduces results to show that a dilute solution of sulphuric acid may be evaporated to dryness on the water-bath without appreciable loss of the acid. — (*Zeitschr. anal. chem.*, xxii. 182.) C. F. M. [876]

Determination of lactic acid. — R. Palm states that lactic acid is completely precipitated when it is added in aqueous solution to an alcoholic ammoniacal solution of basic plumbic acetate. The plumbic lactate is washed with alcohol, since it is somewhat soluble in water. — (*Zeitschr. anal. chem.*, xxii. 223.) C. F. M. [877]

Flow of liquids on the surface of a burette. — In measuring liquids from a burette, Prof. R. B. Warder finds that an error may be introduced by the gradual rise of the meniscus, if the reading is taken too soon after the flow of the liquid is stopped. After a discharge of 60 cc. of a one-eighth normal solution of sodic hydrate, the meniscus continued to rise for ten minutes. — (*Proc. Ohio mech. inst.*, ii. 46.) C. F. M. [878]

A new method for the determination of arsenic. — Mr. Richard Pearce, of the Boston and Colorado smelting company, described a method for the quantitative estimation of arsenic, as suggested by himself, and developed by Albert H. Low, chemist of the company. It consists in first fusing the mineral, ore, or furnace-product supposed to contain arsenic, with sodium carbonate and potassium nitrate, ex-

tracting the soluble arseniate with water, acidulating the solution with nitric acid, boiling to expel carbon dioxide, neutralizing carefully with ammonia (the reaction should be faintly alkaline rather than acid), and precipitating the arsenic in the cold with argentic nitrate as the brick-red salt Ag_3AsO_4 . The latter is thrown on a filter, washed well, dissolved in nitric acid, and the silver determined by titration with ammonium or potassium sulpho-cyanate, whence the arsenic can readily be calculated. The results communicated showed very remarkable concordance, and apparently a high degree of accuracy. The exact degree of accuracy does not appear; since the percentage of arsenic in some of the substances tested was not determined gravimetrically, but assumed to be that required by theory. By this method, 0.1 gr. of enargite yielded 19.03 and 19.09 % arsenic in successive trials. 0.05 gr. pure proustite gave 15.08 % arsenic, while 15.15 % is theoretically required. An ore mixture gave respectively, 3.26, 3.30, 3.19, and 3.25 % arsenic in different trials. A copper matte yielded 0.47 and 0.46 % arsenic in successive determinations. Antimony, the presence of which in solution would vitiate the results of analysis, is almost entirely excluded by the use of sodium carbonate in the fusion. In a mixture of the enargite above tested with stibnite, 19.13 % arsenic was found. No experiments were made to test the solvent action of the ammonium nitrate in the solution on the argentic arseniate. The advantages claimed for the method are the great ease and rapidity with which a determination can be made, and the high degree of accuracy attainable, fully sufficient, at least, for technical purposes. — (*Col. soc. soc. ; meeting Feb. 5.*) [879]

AGRICULTURE.

Action of peat on insoluble phosphates.—In an extensive series of experiments carried out at the Moor experiment-station in Bremen, Fleischer finds that certain peats exert a very considerable solvent action on phosphates. The first experiments were made in the laboratory by intimately mixing finely ground peat and phosphate, adding water, and allowing the mixture to stand, usually for three days. Peat from the lowland moors showed no solvent action; but that from highland moors (sphagnum peat) acted upon the phosphates in every case but two, dissolving from three or four to over fifty per cent of the phosphoric acid present, according to the nature of the phosphatic material. The materials used may be arranged in about the following order, the more soluble first: pure dicalcic phosphate, precipitated tricalcic phosphate, fine raw bone, steamed bone, commercial precipitated phosphates, bone-ash, crude Mejillones guano, Lahn phosphate. The action appears to be due to the presence of free humic acid, which decomposes the phosphates. In several cases the action went so far as to produce free phosphoric acid. Addition of potash-salts was found to increase the solvent action. These results are entirely in harmony with those that have been obtained in field-experiments on these soils. Almost invariably, insoluble phosphates have given better results than soluble ones, the reason evidently being, that, owing to the small absorptive power of peat, the soluble phosphates are soon washed out of the soil, while the insoluble phosphates yield up their phosphoric acid so slowly that the plants can utilize most or all of it. Experiments were also made in composting phosphates and peat. Here, also, phosphoric acid was dissolved, but not to so great an extent as in the laboratory experiments, where a much more intimate

mixture of the materials was possible. From 0.6 to 9.2 per cent of the total phosphoric acid was dissolved. Potash salts increased the solubility of the phosphates. A large proportion of the phosphoric acid was rendered soluble in ammonium citrate; that is, brought into a condition similar to that of the so-called reverted phosphoric acid. In connection with these experiments, Kissling has studied the effect of the presence of various salts on the action of peat upon phosphates. Potassium sulphate increased the action decidedly, potassium chloride to a less degree, and sodium nitrate and kainit hardly at all. Gypsum and calcium chloride decreased the solvent action, and potassium carbonate destroyed it altogether, presumably by neutralizing the humic acid of the peat. The effect of the potassium sulphate was found to be almost exactly in proportion to the quantity used. Although the solvent action of peat, and of peat and potash salts, appears to be comparatively slight on the large scale, it is not without importance; since, in the soil, it may continue for a long time, and the products of the reaction may be continually removed by the movements of water in the soil and the action of vegetation. Fleischer found, that, after his mixtures of peat and phosphates were washed out, the action appeared to begin afresh; and something very like this must occur in the soil. — (*Landw. Jahrb.*, xii. 129, 193.) H. P. A. [880]

GEOLOGY.

The Bow and Belly River districts, North-West territory.—The rocks of the foot-hills and east of the mountains, according to G. M. Dawson, are entirely of cretaceous and Laramie age, overlain by boulder clay and other beds referable to the glacial epoch. The geology of the region is complicated by the fact, that, in the immediate vicinity of the mountains the beds change considerably in lithological character, the change being such as would be expected to occur on the approach to a shore-line. So far, no reason has been found to suppose that any beds newer than the Laramie (including under this general name the Judith River and Fort Union series) have been found in this district, or, indeed, in any part of the Canadian North-West territory. The general arrangement of the rocks is given in the following table:—

I. Laramie (including Judith River series).—1. Beds of the Porcupine Hills: massive sandstones, with shales, etc. 2. Willow Creek beds: reddish and purplish clays, with gray and yellowish sandstones. 3. St. Mary River series: sandstone shales and clays of general grayish or grayish-green colors. 4. Yellowish sandstones and shaly beds, with a mingling of fresh-water and brackish or marine mollusks.

II. Fore Hills.—1. Yellowish sandstones, with some shales, apparently irregular in thickness and character; mollusks all marine.

III. Pierre group.—1. Blackish and lead-colored shales, with occasional sandstone intercalations, especially toward the mountains.

IV. Niobrara?—Belly River series: sandstones, shales, and sandy clays. Upper part generally grayish; lower, yellowish, and often banded by rapidly alternating beds. Fresh and brackish water mollusks.

Near its base, the Laramie of this region is a persistent lignite or coal-bearing formation. In the Pierre group, the most persistent coal-bearing horizon is at its base, although there is a coal-seam at its summit on Bow River. Mr. Dawson considers the coal-bearing horizon at the base of the Pierre to be nearly equivalent to that at the base of the Chico group, which yields the coals of Vancouver Island at Nanaimo and Comox. (In this connection it is well to remember that the identity of the so-called Chico of Vancouver Island with the group of that name in

California is not by any means established.) The following approximate estimates of the quantity of coal underlying one square mile of country in several localities have been made:—

Main seam, in vicinity of Coal Banks, Belly River, 5,500,000 tons.

Grassy Island, Bow River (continuation of Belly River, main seam), 5,000,000 tons.

Horse-shoe Bend, Bow River, 4,900,000 tons.

Blackfoot Crossing, workable coal in seam as exposed on Bow River, 9,000,000 tons. — (*Geol. surv. Can.*) J. B. M. [881]

Triassic traps and sandstones.—Mr. W. M. Davis last summer visited a number of localities in Massachusetts, Connecticut, and New Jersey, for the purpose of studying the relation of the trap masses to the triassic sandstones and shales. Some of these are dikes traversing the strata at high angles, and about such there has been comparatively little conflict of opinion. But the greater number exist as sheets conforming to the bedding; and these have been regarded by some writers as contemporaneous, by others as intrusive. Mr. Davis finds distinct evidence that some of the sheets were extravasated during the deposition of the strata, being afterward buried as the sedimentation progressed; and he finds equally distinct evidence that other sheets were injected between sedimentary layers already formed, and cooled under pressure. To the first class belong the principal masses of the Connecticut valley, including Deerfield Mountain, Mounts Tom and Holyoke, and the Hanging Hills near Meriden; to the second, belong the East and West Rocks near New Haven, and the Palisades of the Hudson. The principal intrusive masses occur in what are regarded as the lower portions of the formation, and may have been injected while the upper strata were still in process of formation.

A duplication of trap-ridges by faulting is demonstrated in some instances, and suspected in others; and it is pointed out that these faults may belong to a wide system, whose total effect is greatly to expand the outcrop of the formation by duplication. Each of the greater triassic districts presents a wide expanse of strata, with a prevailing dip at a considerable angle in one direction. To account for the phenomena by tilting alone, assumes an amount of deposition and subsequent erosion appalling even to the geologist; while the erosion demanded by the hypothesis of tilting and faulting combined is readily admissible.

The observations are prefaced by a bibliography of the subject, and followed by a general discussion, which includes an excellent digest of the opinions and observations of earlier writers. The paper makes a pamphlet of sixty octavo pages, illustrated by three plates. — (*Bull. mus. comp. zool., geol. ser.*, i., no. ix.) G. K. G. [882]

Ore-deposition by replacement.—As a result of his geological studies in Leadville, Col., Mr. S. F. Emmons has reached the conclusion that the 'carbonate deposits' of that locality were not formed by the filling of pre-existent cavities. They belong to a class of deposits for which he proposes the name *metamorphic*, and which are produced by a metasomatic interchange between exotic matter and original rock material. In Leadville the original rock is a dolomitic limestone, 150 to 200 feet thick; and the replacement has occurred either at or near its contact with an overlying sheet of porphyry. The introduced or vein material consists of silica and metallic minerals. These were brought in solution by percolating waters, having been previously dissolved from the

associated eruptive rocks. In places the whole bed of limestone has been replaced, but in general only a portion. The equivalent vein occupies less space than the limestone; but, allowing for this difference, the thickness of vein and the thickness of residual limestone are complementary.

Mr. Emmons regards the class of metamorphic deposits as an extensive one, including a large proportion of the so-called fissure-veins, both calcareous and siliceous, of the Rocky Mountain region. — (*Phil. soc. Wash.*; meeting April 7). [883]

MINERALOGY.

Products of the alteration of corundum.—The following are the results of observations made by F. A. Genth:—

Alteration into spinel.—At the Charter mine, Madison County, N.C., corundum occurs crystallized, and in cleavage masses of a grayish or white color. In the cracks of the same it can be noticed that a change has taken place; and in many cases this extends through large masses, converting the corundum into a massive greenish-black spinel, rarely showing octahedral crystals. The same has a gravity of 3.751. Scales of prochlorite, into which the mineral finally passes, are often present. Analysis of the carefully selected material indicates that it has the composition of a spinel.

Alteration into zoisite.—At Towns County, Ga., pink crystals of corundum are found, surrounded by greenish-white cleavable zoisite.

Alteration into feldspar and mica.—The author cites many occurrences in which cleavable masses of oligoclase and albite surround a core of undecomposed corundum, also where the corundum is surrounded by flat, cleavable mica (muscovite) or a delicate fibrous mica (damourite). Sometimes the mica and feldspar occur together; and the nucleus of undecomposed corundum appears on its exterior very rough, as if it had been eaten into. Numerous analyses are given to prove the identity of the decomposition products.

Alteration into margarite.—This occurs more seldom than the alteration into potash mica; and in some cases scales of the latter are interposed between the margarite, which usually is compact in its nature. Specimens showing this alteration are from Jackson and Iredell counties, N.C., and from Unionville and Aston township, Penn.

Alteration into fibrolite.—Specimens from near Norwich, Conn., and Burke county, N.C., show radiated fibrolite surrounding crystals of unaltered corundum. It seems as if, in many cases, the fibrolite had undergone a subsequent change into mica.

Alteration into cyanite.—At Iredell and Wilkes counties, N.C., bladed cyanite is found surrounding, and evidently resulting from, the alteration of corundum. From the latter locality the cyanite has partially undergone a change into micaceous minerals. — (*Proc. Amer. phil. soc. Philad.*, xx. 381.) S. L. P. [884]

GEOGRAPHY.

(*Arctic.*)

Geographical notes from the north.—The record of the Eira expedition appears in the *Monthly record of geography* for April, giving an account of the voyage up to Aug. 21, 1881, when the vessel was pierced by the ice, and the subsequent proceedings of the party until their rescue during the following summer. Even during the arctic winter, warm southerly gales occurred, which resulted in limited areas of open water. — Prof. Nordenskiöld's expedition will

sail some time during May, and will attempt a journey eastward over the ice from Auleitsvik fiord, in lat. $68^{\circ} 30'$, near Egedesminde. Later an attempt may be made to penetrate northward along the south-eastern coast. — No new information has been obtained from the remainder of the Jeannette survivors, recently examined by the Naval board. — In a recent lecture, Mr. E. H. Hall stated that the population of Newfoundland and Labrador amounts to 190,000, about one-quarter of whom subsist by the fisheries, which are valued at four and a half millions of dollars annually. The copper-mines produce about 45,000 tons of metal annually. — A hurricane in British Columbia recently destroyed four vessels in Victoria harbor, and was attended with some loss of life. — The fur-seal fishery off Cape Flattery has been very productive this season, over 20,000 seals having been secured. — The Newfoundland hair-seal fishery has also been remarkably successful, more than 200,000 hooded and harp seal being reported taken. On the other hand, the Dundee fleet, in the same waters, is said to have made a poor catch. — Ensign Stoney, U.S.N., will sail early in May in the revenue-cutter Corwin to distribute the presents from the government to the Chukchis, of St. Lawrence Bay, Bering Strait, who succored the crew of the U.S.S. Rodgers, which was burned in that bay while searching for the Jeannette party. — The growing scarcity of salmon for canning, in the Columbia River and southward, has led those interested to push into the undepleted waters northward. Several new fisheries have been established on the Skeena River, and others on the Chilkat River, and even in Cook's Inlet, nearly to latitude 60° N. — Four steam-whalers, built on the Pacific coast, will join the Bering Strait fleet this season. They are fitted with all the latest improvements, including iron tanks for oil and blubber, and are appropriately named the Orca, Bowhead, Narwhal, and Balaena. — It has been a very open season in Alaska, and in the south-eastern portion the snow was reported nearly gone March 25. — The aboriginal inhabitants of middle and northern Siberia, especially the Ostiaks and Samoyeds, are apparently either at a standstill, or even decreasing in numbers. According to recent investigations of Yadrintseff, their situation is precarious; and that they should gradually die out, as seems inevitable, is the more unfortunate, since many of them possess much intelligence and numerous good qualities. — In *Petermann's Mittheilungen* for April, Dr. Rink describes the investigations of the Danes in Greenland during recent years, in mineralogy, geology, geography, botany, and archeology, and gives a geological map of the west coast between Disco and Prøven. — W. H. D. [885]

(South America.)

Chilian province Arauco. — A physical sketch of this province, by J. Sieveking, divides it into the littoral slope, the coast or Nahuelbuta range, the central plain, and the great Cordillera. The Nahuelbuta range extends north-north-west to south-south-east, and reaches an elevation of 5,000 feet. Its rocks are granite and crystalline schists, broken by basalt eruptions, and furnish gold to the streams. The auriferous gravels gave a rich yield to the early Spaniards, who forced the Indians to work them; but the latter rebelled, and drove away their would-be masters. In late years gold-washing has been again attempted with moderate success. Between the mountains and the coast is a hilly country, some twenty miles wide, rising to 1,000 feet elevation. It consists of Jurassic and later conglomerates and sandstones, which enclose valuable coal-beds, three to nine feet thick, with

a low percentage (two and a half) of ash. In Arauco little mining-work has yet been done: but, in the adjoining province on the north, the output reaches 10,000 tons a month; and with the rapid increase of steam-navigation along the western coast, of railroads in the interior, and of smelting and saltpetre works in the north, where fuel is scarce, this product must grow rapidly. The author believes the coal to be Jurassic, and not tertiary, as it has been described. All the coast range and littoral slope are heavily wooded, the climate rough and wet, especially in winter; the streams are short and not navigable, and, on nearing the coast, they cross a low plain of recent elevation. The harbors are open to the north-west, but closed on the south-west by the extension of sand-bars built up by the heavy waves and strong northward current. The central plain proves well adapted to agriculture and grazing at the few points where it has been settled; but the greater part is still unoccupied, except by the Araucanians, who maintain possession of a considerable share of good land in the south. Little is known of the Cordillera (it has hardly been entered), as winter begins early there with heavy snow-storms. The stones brought down by its streams are nearly all porphyritic, and sedimentary rocks are quite absent. There are two volcanoes on the range, — Antuco, which Pöppig found active; and Villarica, near the lake of the same name. — (*Peterm. Mitth.*, 1883, 57.) W. M. D. [886]

(Africa.)

Lake Moeris. — Another of the stories of Herodotus seems to be gaining ground. In 1871 Rousseau-Bey found, by levelling, that the present lake, Birket-el-Kerun, in the Fayum (cf. Schweinfurth, *Zeitschr. f. Erdk.* Berlin, xv. 1880, 152, map), is at surface and bottom 41 and 55 met. respectively below the Mediterranean, and that its former level was 10 met. above the same datum, giving an original depth of 65 met. and a greatly extended area. Comparing this with the description of the 'Meridis lacus,' given by Herodotus, Mr. F. C. Whitehouse was confirmed in his trust of the old geographer, and, after some preliminary excursions, set out from Cairo early in 1882, and succeeded in finding by aneroid measurement a considerable depression south of Birket-el-Kerun, with its lowest point 180 feet below the Mediterranean, separated from the northern basin by a low divide (gisr), that seemed decidedly below the level of the Nile in this latitude. The southern end of this depression was not visited; but, as now mapped, the entire basin, if flooded from the Nile, might approach the area, and reach the depth, given for it by Herodotus, although his description has generally been discredited, along with his assertion that it is 'manifestly artificial.' But this, also, Mr. Whitehouse seems to accept, as he speaks of the basin as a 'victory of mind over matter,' and suggests that we should treat the Mississippi as the Egyptians did the Nile. This conclusion, and the severely critical animus shown towards earlier writers, are the less satisfactory parts of the paper, which, in its evidence of work, its review of the cartography of the Fayum, and its quotations concerning Lake Moeris from ancient authors, contains much of interest. — (*Bull. Amer. geogr. soc.*, 1882, 85, map.) W. M. D. [887]

Southern Abyssinia. — P. Soleillet writes from Ankober, Nov. 10, 1882, that he had made good progress, and obtained from King Menelik valuable concessions for the commercial company that he represents. A vast agricultural territory was open to their occupation and cultivation. Olive-forests were found to be very extensive: their fruit might be

improved by grafting, and the company was conceded half of the yield for the next twenty-five years. Permission was given to lay a narrow-gauge railroad from Obok, at the head of the Gulf of Aden, past lake Aussa, to Shoa, following up the left bank of the 'Ouache' (Hawash), where the construction would be easy and cheap. — (*Comptes rendus soc. geogr. Paris*, 1883, 36.) (The road projected would be at least two hundred miles long, and partly in a very unproductive country; so that, in spite of the present activity of African development, this project can hardly expect an early completion.) — W. M. D. [888]

(Atlantic Ocean.)

The Faraday Hills. — Dr. O. Krümmel has discussed the Atlantic soundings published by the Siemens Brothers (see 439), and shows that the Faraday Hills (about lat. 50° N., long. 30° W.) are very probably formed by submarine volcanic eruption. The soundings are so numerous and exact, that a trustworthy profile across the hills is constructed, exhibiting their surprisingly steep slopes (13 to 17° on one side, and 35 to 25° on the other), and revealing them as a mass about six miles broad at the base, rising from a bottom 1,300 to 1,700 fathoms deep to a summit about a mile broad in a minimum depth of 630 fathoms. Their form is therefore truly volcanic, and their altitude approaches six thousand feet. They are of rocky or stony surface, and have no ooze characteristic of deep-sea bottoms. The Flemish cape on the eastern slope of the Newfoundland banks is also stony, but this is regarded as a deposit of drift from melting icebergs. — (*Ann. hydrog.*, 1883, 5, 146.) W. M. D. [889]

The Triton in the North Atlantic. — A sounding expedition on the British steamer Triton, under direction of Mr. Murray, formerly geologist on the Challenger, spent about a month in August and September last in exploring the Atlantic from the Shetland to the Faroe Islands, where, according to previous explorations, a shallowing of the bottom, named the 'Wyville-Thomson ridge,' separated the deep cold water on the north at 32° F. from the warmer bottom-water on the south at 47° F. In the northern part of the ridge, a depression was found with a depth a little over three hundred fathoms, through which some of the arctic water may pass southward. The shallower parts of the ridge, with a minimum depth of two hundred and sixty fathoms, is covered only with gravel and stones, and some of the latter showed distinct traces of glacial action. The fragments are of sandstone, diorite, mica-schist, gneiss, limestone, etc. Several new species were added to the faunae of the warm and cold areas first described in the results of the Lightning and Porcupine expeditions in 1868, 1869. — (*Ann. hydrog.*, 1883, 194.) W. M. D., [890]

BOTANY.

(Physiological.)

Extravasation of water from leaves. — This interesting phenomenon has been carefully examined by Volkens, who, while adding little that is really new, has shown the relations of the water-pores to the underlying tissues in a large number of families. It may be said, that, with three exceptions, the points of secretion were confined, in all cases examined, to the upper side of the leaf. The places are always distinguished by color, swelling, or some equally well-marked indication. The number of the pores is typical in many families and sections. — (*Jahrb. bot. gart. Berlin*, 1883, 167.) G. L. G. [891]

Continuity of protoplasm in contiguous cells. — Hillhouse's method is a modification of Sachs's, and consists in using dilute sulphuric acid on thin sections, following this by concentrated acid for several hours, thoroughly washing with water, and finally staining with ammonia-carmin. By this means it is possible to break down cell-wall without disturbing the protoplasmic threads. A similar process was used by Gardiner in his study of *Mimosa*. — (*Bot. centralbl.*, xvi. 1883.) G. L. G. [892]

Variable dichogamy. — Though as a general rule the Indian corn (*Zea*) appears to be imperfectly protandrous, — beginning to shed its pollen one or more days before the stigmas of the same plant are developed, but continuing the process for several days afterward, — in no small number of instances the dichogamy is reversed, so that the plant is strongly protogynous, while it is sometimes synœmic, — staminate and pistillate flowers maturing at the same time. This, with the similar behavior of the perfect flowers of certain species of *Ribes*, notably the golden currant, shows pretty clearly how either sort of dichogamy may have originated in what were at first synœmic species. — (*Rural New-Yorker*, April 14.) W. T. [893]

Self-impotence of red clover. — For six years Prof. Beal has been experimenting on the fruitfulness of *Trifolium pratense*, when self-pollinated and when crossed by humble-bees. Though the results obtained in the several years differ greatly, — from absolute self-sterility to the production of two-thirds as many seeds as by crossing, — they agree in showing a marked increase of seed where bees have worked. A source of error which tends to diminish the apparent value of crossing is the impossibility of excluding species of Thrips and other small insects by means of the netting used to cover the plants for the exclusion of bees, so that it is probable the degree of self-impotence is greater than appears from these experiments. The general results may be gathered from the appended table of ratios: —

	Bees excluded.	Bees admitted.
First year	66.6	100
Second year	63.5	100
Third year	{ First crop, 1.3 Second " 0.0	100 (0:337).
Fourth year	Not counted accurately	(0:many).
Fifth year	1.2	100
Sixth year	27.2	100
Average	26.6	100

— (*Rep. bot., Mich. agric. coll.*, 1881-82; *Amer. agric.*, Jan.) W. T. [894]

(Systematic.)

Flora of Madagascar. — The most important novelties among the Polypetalae of recent English collections in Madagascar are described by Mr. J. G. Baker, including about 135 species. The woody character of the vegetation is remarkable, as shown by this list, in which are 40 trees, and 64 shrubs and woody climbers, against 31 mainly herbaceous perennials and annuals. — (*Journ. Linn. soc. Lond.*, March, 1883.) S. W. [895]

New Bermuda plants. — The flora of the Bermudas, like that of the Azores, is remarkable for the almost complete absence of endemic species. With the exception, perhaps, of the palms, as yet imperfectly known, the only peculiar plants are two that have been recently described by Mr. Hemsley, and

these may yet be found to occur in the West Indies, or on the mainland. One is *Erigeron Darrellianus*, with the habit and foliage of *Conyza rivularis*; the other, *Statice Lefroyi*, hitherto identified as *S. Caroliniana*. — (*Journ. bot.*, April, 1883.) s. w. [896]

ZOOLOGY.

Mollusks.

The position of Rhodope. — The views of Graff (*Morph. jahrb.*, viii. i.), referring Rhodope to the nudibranchiate mollusks, have received such wide publicity that it is well, even if a little late, that the views on this topic of the most eminent living student of the nudibranchs should have a hearing. R. Bergh of Copenhagen has examined Rhodope with special reference to the views of Graff, and finds, notwithstanding the fact that it is separated by marked characters from the ordinary turbellarians, that the differences between it and the nudibranchiate gastropod mollusks are much greater. There are no nudibranchs destitute of a heart, or of an organ filling the office of a kidney. Few have the liver reduced to a single mass. The genital organs of Rhodope do not differ greatly from those of turbellarians. The form and armature of the tail resemble those of many turbellarians, and nothing similar is known among the nudibranchs. Certain resemblances assumed to exist between the nervous system in Rhodope and Tethys, on the basis of Ihering's figure of the latter, have no force, since it appears that the figure is inaccurate. Lastly, a quietus is placed upon the theory by the fact that the larva of Rhodope has neither larval shell nor velum, which are universal in nudibranchs. It is therefore certain that Rhodope is no nudibranch, and eminently probable that it is nothing more than a peculiarly aberrant turbellarian. — (*Zool. anz.*, 123.) w. h. d. [897]

Fischer's Manuel de conchyliologie. — Part fifth of this excellent work is at hand, comprising pp. 417-512, which carry it forward from the Ascorceratidae, concluding the Cephalopods, through the Pteropods, and nearly through the order Pulmonata in the class of Gastropoda. The latter is divided as follows: —

Class GASTROPODA.

				Class GASTROPODA.
			{ Androgyna }	Order Pulmonata.
Subclass UNIVALVIA	{			Opisthobranchiata.
	{	Dioica	{ Heteropoda .	Nucleobranchiata.
			{ Platypoda .	Prosobranchiata.
Subclass MULTIVALVIA				Polyplocophora.

The author's paleontological researches have enabled him to preserve a satisfactory equilibrium as regards living and extinct forms. Numerous new and characteristic figures appear in the text, in addition to others not unfamiliar in the pages of Woodward; and with this fasciculus is added an atlas of twenty-four plates, which originally appeared in Woodward's Manual, and are well known, but which have never been excelled in clearness and accuracy by any purely black and white conchological plates issued up to the present time. The most casual inspection of the text, however, will show that we are presented with something quite different from a merely revised edition of Woodward, and that the volume when completed, though doubtless open to criticism in some of its details, will be by far the best text-book of the subject available. — w. h. d. [898]

Anatomy of Parmacella. — H. Simroth devotes a paper of forty-six pages, with an excellent plate, to the elucidation of the anatomy of *P. Olivieri* Cuvier. Its features are compared in detail with homologous organs in other pulmonates; and among his deductions the author concludes that the slugs constitute

the highest evolution-product of the group of Pulmonata (a view in which he was long preceded by A. A. Gould and others), and that Parmacella, in particular, exhibits closer relations with the Patula-section of Helicidae than with the group including Vitrina, etc., with which some other slugs are most closely allied. — (*Jahrb. deutsch. mal. gesellsch.*, i. 1883.) w. h. d. [899]

Curious slug from Madagascar. — Heynemann describes under the name of *Elisa bella* a curious slug allied to *Amalia*, with a spatulate internal shell, dorsal keel, four retractile tentacles, a jaw resembling that of *Limax*, radula like *Helix*, and a terminal slime-gland accentuated by a short deep groove extending backward on each side from it. It is in the Senckenbergian collection. — (*Jahrb. deutsch. mal. gesellsch.*, i. 1883.) w. h. d. [900]

Crustaceans.

Metamorphosis of Penaeus. — Walter Faxon calls attention to the fact that Fritz Müller did not keep the supposed *Penaeus* nauplius under observation until it changed to a protozoa, as is stated by W. K. Brooks in his recent account of the metamorphosis of *Penaeus* (*Johns Hopk. univ. circ.*, Nov., 1882), and that, consequently, the rearing of the protozoa to the young *Penaeus* by Brooks proves nothing new in regard to the relation of Müller's nauplius to *Penaeus*. Faxon, however, sees no good ground for refusing to accept Müller's reasons for believing his nauplius and zoea stages to be parts of one life-history. — (*Amer. nat.*, May, 1883.) s. i. s. [901]

Copepoda living in mollusks and ascidians. — C. W. S. Aurivillius has investigated the Copepoda inhabiting mollusks and ascidians on the Swedish coast, and published the results in two papers illustrated with seven double plates. Only two species, both belonging to the Sapphirinidae, were found inhabiting mollusks, — a species of *Lichomolgus* on species of *Doris*, and a new genus and species (*Modiolicola insignis*) upon the branchiae of *Modiola* and *Mytilus*. Twenty-one species, representing seven genera and five families, were found in the branchial sacs of ascidians, two new species being added to those already described by Thorell and others. Nearly all the old species are redescribed, and a large part of them figured, and analytical tables of the genera and species given. — (*Öfvers. vet. akad. förh.*, 1882, Nos. 3 and 8.) s. i. s. [902]

Insects.

Life-histories of American butterflies. — W. H. Edwards continues his careful and valuable descriptions of the early stages and habits of different American butterflies, giving us lately those of *Grapta comma*, *G. interrogationis*, and *Pyrameis Atalanta*. The descriptions of the caterpillars lose part of their value through lack of sufficiently explicit statement of the precise location of the dermal appendages. — (*Can. ent.*, xiv. 189, 201, 229; xv. 14.) [903]

Natural history of the fig-insects. — The very singular little group of fig-dwelling hymenoptera, referred by Westwood to the Chalcididae, is the subject of a recent monograph by Dr. Paul Mayer. Fig-growers have for ages taken advantage of the habits of *Blastophaga grossorum* for cross-fertilizing the tame fig with the wild caprificus. Mayer describes the anatomy of this species and some others, and discusses the geographical distribution of all known species, and their relations to the species of *Ficus* and its allies. The amount of adaptation induced by the peculiar habitat of the fig-insects varies in different

genera, the least abnormal forms being South American. The two sexes often differ enormously; the male of some forms losing wings, mouth, and ocelli, and having eyes and antennae of small size. — (*Mittheil. zool. stat. Neapel*, iii. 551, pl.) E. B. [904]

(*Economic entomology.*)

The pine moth of Nantucket.—Detailed accounts of the different stages, except the egg, and of the habits of *Retinia frustrana* Scudd., are given by S. H. Scudder. The paper is illustrated by an excellent chromolithographic plate. The author is inclined to believe the insect described under the same name by Comstock (*Rep. U. S. dep. agric.*, 1879) is specifically distinct. — (*Pub. Mass. soc. prom. agric.*, 1883.) J. H. C. [905]

The spruce Tortrix.—The natural history of *Tortrix fumiferana* Clem. is given by C. H. Fernald. (*Ann. rep. st. coll. agric. Maine*, 1882.) J. H. C. [906]

Clothes-moths.—A careful revision of the three species of *Tinea* which infest clothing has been made by Fernald. The common case-making species should be known by the name of *Tinea pellionella* Linn; the species which makes a gallery of the substance on which it occurs is *Tinea tapetzella* Linn; and the third species, which does not make a larval case, but webs together portions of the substance upon which it feeds into a cocoon before changing to a pupa, is *Tinea bisselliella* Hum. — (*Ann. rep. st. coll. agric. Maine*, 1882.) J. H. C. [907]

VERTEBRATES.

(*Physiology.*)

Development of the red blood-corpuscles.—Feuerstack has published a memoir on this subject. He gives first a brief mention of those authors who have sought to trace the development of the red corpuscles from the white; second, an abstract of Hayem and Pouchet's theory of the *haemato blasten*; third, of other views of less importance. The author then presents his own observations and conclusions. "We find in the circulation of animals with nucleated blood-corpuscles every possible transition between colorless and colored blood-corpuscles. That they are transition stages from the white to the colored cells is shown by the course of development during artificially induced blood-formation." The principal places of formation in the pigeon are the osseous medulla, the spleen, the portal system, and the feather-shafts; in the frog, the bony medulla and spleen; in Triton, the spleen, and the lymph sinus near the bladder; in the eel, the spleen and the venal lymph sinus. (The author has overlooked the view, which is the one most plausible to us, that the colored corpuscles are merely nuclei, and not complete cells. His observations seem far from having settled the problem.) — (*Zeitschr. wiss. zool.*, xxxviii. 136.) C. S. M. [908]

Structural changes in the liver, accompanying functional activity.—This subject, which as yet has been little worked at in comparison with the numerous corresponding researches made on other glands of late years, is the subject of an interesting research by Afanassiew. His work leads him to the following conclusions: 1°. Both glycolysis and the formation of bile take place in all the cells of a liver-lobule. 2°. Agencies (section of the liver-nerves or feeding on albuminous diet) which increase the secretion of bile bring about a marked increase in the size of the hepatic cells, which are also seen to contain, in the interspaces of their protoplasmic network, numerous albuminous granules. The cell

limits are distinct, and the nuclei large and granular; the whole organ is firm and resistant. 3°. On feeding so as to get a liver exceptionally rich in glycogen, the cells are found to be enormously large, when compared with those of an unfed animal, their contours sharp, and in the cell body so many amorphous glycogen particles deposited as to compress the proper cell-substance into a mere coarse network stretching from the nucleus towards the periphery. The blood-capillaries are considerably narrowed by compression from the neighboring cells. The whole liver is soft and brittle. 4°. Toluyl-di-amine, which had been found by Schmiedeberg to produce jaundice, causes an increased biliary secretion. This it does by bringing about a great destruction of red blood-corpuscles, whose decomposition products stimulate the liver, and provide material for increased gall-secretion. The experiments were made on dogs. — (*Pflüg. archiv*, xxx. 385.) H. N. M. [909]

ANTHROPOLOGY.

Ethnography of the Caucasus.—In a summary of work by the Russian geographical society, *Nature* has the following language: "Several linguists consider the Armenian language as decidedly belonging to the Iranian group, while others classify it with the European group. Lagarde distinguishes it in three elements, — the Haikan, the Arkasid, and the Sassanid elements. The two latter are Iranian; but the Haikan elements belong to a family of languages the oldest of which is the Zend. Hülschman concludes that it occupies an intermediate place between the Iranian languages and the Slavo-Lithuanian; and Fr. Müller, a partisan of its Iranian origin, admits that it has some kinship with the Slavo-Lithuanian languages. Prof. Patkanoff concludes that it occupies an intermediate place between these two, and is a representative of an extinct group of Indo-European languages, which formerly was spread, perhaps, in Asia Minor." — (*Nature*, March 15.) J. W. P. [910]

Tribes of the Zambesi.—Père Depelchin, leader of the catholic mission on the Zambesi, reports the following tribes along that river, near its confluence with the Chobe: the Ma-Nansa (or Ma-Kalaka), Ma-Laya, Ma-Shukulombwe, Ma-Shubia, Ma-Totala (identified with the Ba-Nyeti), Ba-Rotse (or Ma-Rotse), Ma-Ntchoia, Ma-Mbunda, Ba-Libale, Ma-Pingula, Ma-Hes. These tribes are subject to the empire of the Ba-Rotse. Père Depelchin finds that in Holub's lists the vernacular terms for professions had been entered as the names of separate tribes. The traveller also corrects some difficulties respecting the languages of the tribes. — (*Precis hist.*, Feb.) J. W. P. [911]

Iron in the Ohio mounds.—Mr. F. W. Putnam showed that the iron swords, and plate of cast iron, referred to in the writings of Dr. Hildreth and Mr. Atwater as found in mounds at Marietta and Circleville, never existed. The light shed by recent discoveries showed that the supposed sword-handle mentioned by Mr. Atwater, and the supposed ornaments of a scabbard described by Dr. Hildreth, were common forms of implements and ornaments from the mounds; while 'the iron rust in the copper tube,' or supposed 'end of the scabbard,' was red oxide of copper, and the tube itself was simply a copper bead of ordinary form. Mr. Putnam had studied the original specimens of Dr. Hildreth, which were in the cabinet of the Antiquarian society; and they will be illustrated in his paper, to be printed by the society. — (*Amer. antiq. soc.*; meeting April 25.) [912]

Voyages of Moncatch-Apé.—In reference to the recent notice of M. Le Page du Pratz (see 634),

and the bearded men on the Pacific coast in the beginning of the last century, Mr. A. M. F. Davis concedes the probability of the journey, but doubts the meeting with the bearded men. Although this region was not penetrated by explorers until Lewis and Clark crossed the continent in 1804, still the stories of the Indians bore uniform testimony to the river and the ocean; and there was more or less testimony tending to show the visitations of white men in ships. Such sources of information were open to Indian and Frenchman alike; and Mr. Davis attempts to show, that, upon the skeleton of the story of actual travel furnished by the Indian, Le Page du Pratz builds up the story, which he publishes with its details, as to the bearded men. He finds two endings to the story, — one published in Dumont; the other, in Le Page's own book, — both credited to Le Page. In the later publication of the two, Mr. Davis fancies that he can trace in the changes evidence of knowledge derived from the Bering's expedition, and from publications of the period, which were given to the world about that time. In conclusion, he hopes that no opportunity will be lost to search oriental records, for upon them we must ultimately rely for the permanent disposal of such questions. — (*Amer. antiq. soc. ; meeting April 25.*) [913]

Indians on the Beni River. — The Beni River has been explored from time to time: for instance, by Palacios and by Bursa in 1846, by Lieut. Gibbon in 1852, by Prof. Orton and Ivon D. Heath in 1877, and by the Cura Serabia in 1879. Dr. Heath gives the following note on shirt-making: "Some of the men took time, while stopping for breakfast, to make new shirts. A young Brazilnut-tree of the proper size being found, the bark is stripped off to a height of eight to ten feet. This is taken to the river, placed on a log or stone, and beaten with a stick. When free from outer bark, the fibres are opened, and form a good cloth. This is then folded in the middle, a space left for the arms, the sides sewed down to near the bottom, and a slit cut for the head. When old, these shirts are as soft as old linen." In the journey down the Beni River, Mr. Heath encountered the Tacanas, Cavinás, Pacavaras, Araunas, and Mobimas. The most interesting result of Dr. Heath's anthropological researches is the account of a series of pictographs on the rocks at the falls and rapids of the rivers Madeira and Mamoré. Illustrations of these carvings are given. — (*Bull. Amer. geogr. soc.*, 1882, no. 3.) J. W. P. [914]

Nomenclature of crime. — In a pamphlet by F. H. and W. B. Wines upon the nomenclature of crimes in the United States as an aid to the tabulation of the statistics of crime, the authors have endeavored to collate all offences punishable in the United States under any statute enacted either by the national congress, or by the legislature of any one of the states. Without a knowledge of the laws under which commitments to prison are made in the several states, the statistics of imprisonment are valueless for all purposes of intelligent comparison. The offences enumerated are divided into five classes, as follows: —

I. Offences against the government. 1. Against the existence of the government; 2. Against the operations of the government, — *a.* Currency, *b.* Election laws, *c.* Postal laws, *d.* Revenue; 3. Against international comity.

II. Offences against society. 1. Against public health; 2. Against public justice; 3. Against public morals; 4. Against public peace; 5. Against public policy.

III. Offences against the person.

IV. Offences against property.

V. Offences on the high seas.

The index to this pamphlet covers 59 pages, and is a necessary guide to the contents of the work. — J. W. P. [915]

The archeology of the District of Columbia.

— Dr. J. Meredith Toner, in 1874, founded a medal in Georgetown college, D.C., "to encourage among the students habits of inquiry, and the development of the faculty of close and accurate observation, not only of the rarer phenomena of nature, but of the commonest things met with in daily life." At the commencement in 1882, the successful candidate was Louis A. Kengla, who prepared an essay, now printed under the title of 'Contributions to the archeology of the District of Columbia.' The young author enters minutely into localities and classes of implements, and has furnished a good map and five full-page plates of illustrations. The work does credit alike to the writer and to his generous patron. — J. W. P. [916]

Natives of Borneo. — Some addition to our knowledge of the inhabitants of Borneo and the Sulu Islands is made by Mr. W. B. Preyer, the British North-Borneo company's resident, at Elopura. The inhabitants of the Sulu Islands are divided into Sulus (Malays, with Arab and Chinese blood) and Bajaws, or seagypsies. These are described at length, both as to their physical and their moral characteristics. On the coast-line of Borneo is an extraordinary mixture of people, — Sun-Dyaks, Malays, Javanese, Sulus, Bajaws, Bugis, Chinese, Arabs, Klings, and many others; while of the Buludupies, the indigenous inhabitants of the district, there are hardly any of pure blood left. Allusions are made to slavery, religion, marriage, head-hunting, 'summing-up,' and disease. Mr. Preyer tells a very good story about marriage among the Datos. When a Dato of any consequence marries, he settles upon his bride a dowry of so many slaves, male and female, so many pieces of T. cloth, of silks, chintzes, and sarongs, etc. A house is built for her, and she is settled comfortably. At the end of a few months, the Dato goes off elsewhere, and repeats the process. The abandoned wife goes to work, with her capital and her slaves, to better her condition. Some fine day the Dato sails back to find in every port a house, a wife, and surroundings all comfortable and ready. — (*Proc. roy. geogr. soc.*, Feb. 7.) J. W. P. [917]

EGYPTOLOGY.

Serbonis. — In "The Hebrew migration from Egypt, an historical account of the Exodus, based on a critical examination of the Hebrew records and traditions," by J. Baker Greene, second edition (London, Trübner & Co., 1883), on p. 69, we are told, "In ancient times, if we may trust the evidence of historians, a sheet of water existed on the south side of Mount Casius, and separated by a well-defined but narrow strip of land from the Mediterranean Sea. . . . This was the Serbonian Lake. . . . This lake no longer exists. It has been filled by the drifting sands of the adjoining desert." In a work that makes so much pretension to impartiality and search for truth, egregious errors like this ought to be shunned. The best map yet published of Egypt and the Isthmus of Suez (that in Napoleon's Description de l'Égypte, Paris, 1809-1828) gives the length of Serbonis as a hundred kilometres, and its usual width as eight to ten kilometres. Mr. Greville Chester, in the volume of Special papers issued by the Palestine exploration fund, 1881, has given a very full description of the

lake, with its bright, sparkling waters, free from marine vegetation of any sort.

Mr. Greene also says (p. 76), "The evidence of travellers does not, however, support the suggestion that the Red Sea is remarkable for an excessive supply of seaweed." From Ehrenberg, 'Die korallenbänke,' 1832, to the last and best authority on the Red Sea (Klunziger, Upper Egypt, 1878, pp. 345-376), we are assured of the direct contrary of Mr. Greene's assertion. "A celebrated plant is the shora (*Avicennia*

officinalis), which forms large, dense groves in the sea, these being laid bare only at very low ebb. . . . The sea-grass meadows (*gisua* of the Arabs), which we have already often mentioned, and which are met with partly in depressions in the surface of the reef, partly on the bottom of the sea (especially in harbors), afford concealment to a special class of fishes, many of which are distinguished by possessing a green color." — (Klunziger, pp. 240, 376.) H. O. [918]

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

PUBLIC AND PRIVATE INSTITUTIONS.

Boston society of natural history.

The collection of minerals. — The society has just finished the arrangement of its collection of minerals with the express purpose of offering it as an illustration of the mode of arrangement to be adopted throughout their museum. The curator's report, shortly to be printed, has a detailed account of the collection, from which we give the following account: —

The exhibition is divided into three parts: I. Comparative mineralogy; II. Synopsis of classification; III. Systematic collection.

I. Under the head of comparative mineralogy, the following topics are treated by means of series of specimens: 1°. Composition and chemical relations of minerals; 2°. Form and structure of minerals; crystallography; 3°. Physical properties of minerals.

1°. Under the first head, such subdivisions as the variation of minerals in composition are dealt with in the cases by the exhibition of several selected series, — (a) variations due to original mixtures; (b) variations due to decomposition and alteration; (c) variations due to chemical substitution. The first (a) of these sub-topics, for example, is exhibited in a series of seven minerals. Three of these are varieties of amphibole, and display the distinct colors and aspect due to changes in the chemical composition of the varieties. The second (b) is shown by five minerals, among which are orthoclase and wernerite, — quite distinct substances, but which are undergoing reduction by decomposition to the same mineral, kaolinite. In the third (c) only one substance, pyrrhotite, and its elements, sulphur and iron (which are placed together upon one tablet), is set apart for the exposition of the differences which may exist between the elementary constituents of a mineral, and the compounds resulting from their union.

The relations of water in the composition of minerals is dealt with in a series running from a strictly anhydrous hematite to natron (hydr. carb. sodium), having 55 per cent of water. There are twelve specimens in this series, and behind each specimen a tube exhibits the relative proportion of water.

2°. Form and structure presented no very serious difficulties beyond the need of finding persons capable of making the special models which were required. This was satisfactorily accomplished after some delay.

3°. As examples of the methods pursued in illustrating the physical properties of minerals, we can use the following: —

(a) The density series, showing the range of minerals in specific gravity. This series consists of twenty-seven minerals, including gold, which is twenty-one times heavier than water, and petroleum,

which is lighter than that standard liquid. This gradation is made apparent to the eye by means of glass tubes containing equal weights of each of the substances, reduced in the case of solids to a fine powder. Thus gold, with specific gravity 19.5, the heaviest substance, has necessarily the shortest, and petroleum, with specific gravity .75, the longest, tube; and the intermediate tubes show the gradations between these. Thus a series is formed which exhibits clearly that the volume of minerals is inversely proportional to their specific gravity or weight.

There are a number of series showing the relations of minerals to light, among which we may select, by way of illustration, that of the color test, or streak, of minerals.

(b) Streak series: lustre metallic, and color mainly essential. This label stands at the head of nine specimens, each mounted upon the same block, with a piece of novaculite of uniform size, such as is used to try the streak of minerals, partly covered with a band of the powdered mineral.

(c) Streak series: lustre non-metallic, and color non-essential except when white. This label is at the head of a precisely similar series, but consisting of eighteen minerals with their accompanying stones, exhibiting the great contrast between the color of minerals themselves and of their streaks upon the white surfaces of the novaculite.

(d) There are also series of specimens showing the principal minerals which exhibit electrical properties either in their natural conditions, or only when acted upon by friction or heat.

(e) Even the taste, touch, and odor of minerals are illustrated by similar series. Though persons cannot imagine how a rare mineral tastes, feels, or smells simply from the sight of it, they all know some of the commoner minerals of the same series which are placed on exhibition. With the guidance of the collection, they can also more easily duplicate the specimens, and understand their relations.

II. In the synoptical collection, the more important and abundant elements are here repeated, and each shelf is devoted to one of the grand divisions of the mineral compounds. Each division of minerals is represented by its most characteristic species; and the subdivisions of the anhydrous and hydrous groups are indicated on the labels, wherever these occur.

III. The systematic collection begins with the native elements, which occupy one wall-case next to the synoptical collection. This is followed by the compounds. These fill the wall-cases on the remaining sides of the room; and here are exhibited the different species of minerals arranged in their proper order as classified by Professor Dana, with some slight changes in the succession of the larger divisions.

Models of the principal or most characteristic crys-

talline forms of each important species have been made out of plaster, and the surface hardened with paraffine in order to give a smooth finish. These are mounted in the same manner as the substances whose structure they are used to illustrate.

It was rightfully imagined, when the present general plan of arrangement for the museum was adopted, that the greatest obstacle in the path of any attempt to show that there was a gradation in the natural relations of the products of the earth would be the department of mineralogy. It has been found, however, that the separation of minerals from the mother-rocks, on account of their purer composition and definite forms, although purely artificial, has its logical uses. It enables one to explain with directness and precision the relations of all the elements and their strictly inorganic compounds, and to prepare the mind for the consideration of the more complicated aspects of the geological and biological collections. Mineralogy is therefore made the vehicle for the conveyance of almost all the preparatory facts in physics and chemistry which are essential for the purpose of the museum.

While such definite marks of gradation cannot be found in minerals as among animals and plants, there is in nearly every division of minerals, even with their present entirely artificial and probably unnatural classification, such distinctions as those of anhydrous and hydrous groups, the simple and double sulphides, the binary and ternary compounds. These have not yet been brought into correlation with the molecular structure, or with each other, in any natural classification; and therefore we cannot say that the hydrous compounds are necessarily, on account of the addition of water to their chemical composition, more complicated in their molecular structure than the anhydrous, or that the same is true of the double as compared with the simple sulphides, or yet of the ternary as compared with the binary compounds.

Notwithstanding these difficulties, the facts are in every case facts of gradation. It makes no difference whether the gradation leads up or down, or mingles both of these tendencies. Whatever direction the true classification may eventually take is immaterial. The indications of what is already known show that gradation of some sort must be its marked characteristic; and this alone is sufficient to harmonize the whole provisionally with the other departments of the museum.

Important support, however, is derived from an opinion in which all chemists and mineralogists consulted seem disposed to agree. There are decided grounds for the belief that both the chemical and the molecular constitution of the elements may be considered as less complicated than that of the purely inorganic and probably derivative compounds, and these, in turn, simpler than the hydro-carbons. Theoretically, also, one is safe in assuming that the latter, which are the products of organic bodies composed of their fossil remains, oils, gums, etc., more or less altered by the physical and chemical conditions to which they have been subjected, are of later derivation in time than the strictly inorganic compounds, and that these, in turn, are probably more recent, as a rule, than the elements of which they are made up.

These fundamental facts are quite sufficient for the purposes of the collection, and permit a demonstration of the fact that the same principles of classification apply in this department as in all others, whether inorganic or organic.

The curator is already in receipt of letters from eminent teachers and others, expressing their gratification at the results of the work in this department, and some of them strongly urge the immediate publication of a proper catalogue.

Harvard university, Cambridge, Mass.

The Jefferson physical laboratory.—The plans of the new physical laboratory, presented to the university by Mr. T. Jefferson Coolidge, have now been so far discussed that we may give a general account of them. The building will be placed about in the centre of Holmes Field, in the rear of the Scientific school, to avoid as much as possible all jars from passing vehicles. The nearest street (Oxford Street) will be about 300 feet from the east wing.

The building consists of an eastern and a western section, each 60×60 , connected by a central piece 80×40 ft. The eastern section will contain a large lecture-room, with a seating-capacity of between 275 and 300 students; above this, an immense laboratory, 60×60 ft., for the general use of undergraduates and less advanced students. The basement of this section will be occupied by a workshop, a battery-room, boilers, and coal-bins. The north side of the east section, flanking the lecture-room, is occupied by three stories of rooms for the physical cabinet. These also extend on the north side of the central piece, and are so arranged as to lead conveniently into the lecture-room, the general laboratory, the recitation-rooms, and also into the western section, where the rooms for special investigations are located.

In the central piece, besides the space occupied by the cabinet, there are two recitation-rooms, a balance-room on the first floor, and, on the third floor, rooms for electric measurements, photometry, and a general library and balance room. Small entries and stairways at the east and west end of the centre piece give easy access to all parts of the building for the professors and special students. The undergraduates have access to the lecture-room and general laboratory at the east end of the building by a stairway removed as far as practicable from the rooms devoted to special investigations. This arrangement, and the position of the engines and dynamos on the outside of the building across a deep insulating ditch, will prevent the jar of the machinery and the tramping of students from interfering with delicate observations.

The basement of the central piece is occupied by receiving-rooms, and storage for heavy pieces of apparatus.

The western section is the one which the professors and instructors of physics have most carefully considered. The lower floor contains rooms of moderate size, devoted to general use and special investigations, —rooms which will be fitted up with reference to electricity, heat, magnetism, and sound. In each room of the first floor there are independent piers, built up from the basement, insulated from the walls and floors upon which delicate instruments are to be placed. Similar rooms devoted to optics, electricity, and the Rumford laboratory, are located upon the second story. The third floor is as yet assigned to no definite use, and, with the exception of a room for photography, can be left to meet the wants of the future. The basement of this section is occupied by a room for magnetism, one for heat, and one for weights and measures. A room for constant temperature is excavated below the basement floor in the centre of the building.

To afford facilities for the study of atmospheric physics and experiments for which great height is

needed, a tower runs through the central part of the western section. The tower has a total height of 60 feet; it is built with double walls to isolate it from the rest of the building, the outer walls carrying the floors.

Above the roof, the sides of the tower are almost entirely of glass. There is free access to the four sides of the tower, as well as to the top, which is at a height of 72 feet from the basement-floor. Openings are left at every story to allow light to be sent to the central part of the tower. The piers of the first floor are also so arranged as to obtain lines of considerable length across the building. The doors are so placed that adjoining rooms are readily thrown open together.

The laboratory, built to commemorate Ellen Wayles Coolidge, grand-daughter of Thomas Jefferson, has been named the 'Jefferson laboratory.' It seems most appropriate that the name of one who was among the first to recognize the value of university education in this country should be connected with a building to be devoted to the investigation of some of the most interesting problems of nature.

The cost of the building, with the necessary fixtures, will be about \$115,000. There is a fund of \$75,000, the income of which is to be expended for the benefit of the physical laboratory, in addition to the appropriations and expenditures now incurred for physics by the college.

NOTES AND NEWS.

Zoölogists the world over will regret to learn of the death of the genial and talented Wilhelm Karl Hartwig Peters, director of the zoölogical museum of Berlin, and younger brother of Dr. Peters of our own Clinton observatory. Dr. Peters was born at Coldenbüttel, near Eiderstedt, in Schleswig, on April 22, 1815, and died in Berlin on the 20th of last month. Immediately after completing his studies in medicine and natural history at Copenhagen and Berlin, he undertook a journey to southern France and Italy to investigate the fauna of the Mediterranean. Returning to Berlin in 1840 as assistant in the anatomical institute of the university, he soon laid his plans for an independent investigation of the unexplored regions of Mozambique, in which he received the advice and support of his distinguished friends, Johannes Müller, Humboldt, Ritter, Ehrenberg, and Lichtenstein, and the powerful patronage of the king, Frederic William IV. He left for this journey—the great event of his life—in 1842, and was absent more than five years. Two years were spent in the interior of Mozambique; but he also made journeys to the Comoro Islands, to Zanzibar, Madagascar, and the Cape, and, before his return, visited the coast of India. His *Reise nach Mozambique*, published between 1852 and 1868 in five quarto volumes, is the result of this exploration, and is a model for faunal work of this kind. Returning to Berlin in 1848, he was made professor at the institute, afterwards professor extraordinary, and in 1857 succeeded Lichtenstein as full professor in the university, and director of the zoölogical museum. The museum, under his administra-

tion, early took the highest rank, which it has ever since held; and more than one American student has been cordially received within its walls. Peters's studies were mainly given to the world in Müller's Archiv, and the publications of the Berlin academy, to which he was elected in 1851. They covered nearly the entire field of zoölogy, but were specially devoted to mammals, reptiles, amphibians, and fish. His geographical discoveries in Mozambique were published by Kiepert in 1849 in a map; and Bleek's *Languages of Mozambique* contains a portion of his linguistic studies.

—The April number of the Harvard university bulletin, which has just appeared, contains fifty-six pages, of which thirty-one are devoted to the book-list. We notice recorded a copy (one of thirty) of the Maya manuscript in the Dresden library, reproduced in polychromatic photography. The appendices contain another instalment of Mr. Bliss's classified index to the maps in Petermann's Geographische Mittheilungen (twelve pages), and of Mr. Winsor's valuable bibliography of Ptolemy's geography (seven pages). The University notes mention additions to the zoölogical museum, the purpose of the observatory to collect astronomical photographs, and give an account, reprinted on p. 437, of the plans of the new Jefferson physical laboratory. Among the appointments gazetted, we notice that of Mr. J. Rayner Edmonds and Mr. John Ritchie, jun., to the observatory, to be in charge of the time-service and the distribution of astronomical information respectively.

—A general veterinary establishment for the treatment and care of lame, sick, or wounded horses, cattle, sheep, and dogs, is to be maintained in connection with the school of veterinary medicine, of Harvard university. The hospital will probably be ready for occupation June 15. The patients will be under the professional charge of Mr. Charles P. Lyman, fellow of the Royal college of veterinary surgeons, London, and professor of veterinary medicine in the university. The school will also have at its disposal commodious buildings and pastures at the Bussey farm, where cattle can be received and cared for, and where horses not required for present use, or suffering from lamenesses or illnesses which require long seasons of rest, can receive all proper care and treatment, together with the benefit of grass-paddocks in summer, and a warm straw-yard in winter. Any person having sick or lame animals to be cared for can procure for them the benefits of the establishment upon the payment of a fixed sum per day, covering board, treatment, and medicines. To each subscriber of ten dollars a year, a number of privileges will be given. On Tuesdays and Fridays a free clinic will be held.

—The semi-annual meeting of the American antiquarian society was held in Boston on April 25 at eleven o'clock. About fifty members were present. The reports of the officers showed that the affairs of

the society were in good condition, although the council felt the need of a special fund for the salary of a person to fill the place of the late Dr. S. F. Haven. Mr. Samuel S. Green of Worcester read a paper of local interest in relation to the First parish of that city; Mr. Andrew M. F. Davis of San Francisco discussed the question of bearded men reported to have been seen by Moncatch-Apé on the Pacific coast of America before 1758; Mr. F. W. Putnam of Cambridge gave an account of the use of native metals by the mound-builders of the Ohio valley, and exhibited ornaments from the mounds made by hammering native copper, silver, gold, and meteoric iron; Mr. Putnam also read a paper on Iron in the Ohio mounds, a critical review of the misconceptions of two writers of sixty years ago; and Mr. H. W. Haynes of Boston presented by title a paper on Ancient soapstone-quarries. Two of these papers are noticed more fully in our Weekly summary. After adjournment the members were invited to lunch at the residence of Mr. James F. Hunnewell in Charlestown, after which a visit was made to Bunker Hill by invitation of the directors of the Monument association.

—Mr. F. W. Putnam lectured on Recent discoveries in American archeology before the Harvard historical society, Cambridge, May 7, illustrating his discourse with stereopticon views.

—The effort to raise money to pay off the debt of the Academy of sciences of Davenport, Iowa, has met with good success. Not only has enough been obtained for that purpose, but a start has been made with an endowment fund to place the institution on a firmer basis. The feeling of interest in the academy, which was created among the business-men at a meeting held April 24, continues to spread. There seems to be little doubt that the continued usefulness of the institution is assured.

—At the meeting of the American academy of arts and sciences, April 11, the papers read were by Professor William A. Rogers, Results of the comparisons of three independent copies of the imperial yard, and of four independent copies of the metre of the archives; Dr. Otto Struve, Aberration; Mr. S. C. Chandler, On the variable star, R. Aquarii; and by Prof. E. C. Pickering, on the measurements made of the photographs of stellar spectra obtained by the late Dr. Henry Draper.

—At a meeting of the section of mechanics and engineering of the Ohio mechanics' institute, held April 24, Mr. Alfred R. Payne read a paper on Utilization of sewage from the hills, discussing the value of both the fertilizing material and the water-power.

At the meeting of the section of chemistry and physics, April 26, papers were read by Prof. F. W. Clarke, on Tartrates of antimony; by Prof. H. T. Eddy, on the Kinetic theory of solids, fluids, and gases; and by Professor Robert B. Warder, on a

Proposed systematic computation of data relating to the speed of chemical reactions. The section resolved to undertake the computation (on some fixed system of units), with such co-operation as other chemists and physicists may kindly afford.

—The summer course of instruction in botany in Harvard university will begin on July 6, and continue six weeks. The principal part of the instruction will be given by Professor William Trelease of the University of Wisconsin, but lectures will be given also by Professor Goodale.

—At the meeting of the Biological society of Washington, April 27, the following communications were made: Prof. C. V. Riley, Another jumping-seed, Remarks on bee-fly larvae and their singular habits, A burrowing butterfly larva; Mr. H. H. Birney, Remarks on *Samia cynthia*, the Ailantus moth; Professor Theodore Gill, The Stromateidae; Dr. Frank Baker, The origin of dextral preference in man. A field meeting of the society took place on Saturday, April 28, at Bladensburg.

—At the meeting of the Society of arts of the Massachusetts institute of technology, April 26, Mr. A. E. Burton spoke on the Topographical methods of the U. S. coast-survey, and Mr. W. H. Pickering on the Sensitiveness of photographic plates.

—On the 31st of March, the Weymouth and Channel Islands steam-packet company's steamer *Aquila*, on her way across the channel, was suddenly struck by mountainous seas, which sent her on her beam-ends, and washed the decks from stem to stern. As the decks became clear of water, the bulwarks were found to be broken in several places, one of the paddle-boxes was considerably damaged, the iron rail on the bridge was badly twisted, the pump was broken, the skylights broken, and the cabins flooded. Five minutes after the waves had struck the steamer, she came again into smooth water.

—In 1882 there were built and registered in the United Kingdom, as British ships, 453 iron steamers having a gross tonnage of 676,338, and 64 steel steamers having a gross tonnage of 113,389. The percentage of steel gross tonnage is 14, while for 1881 it was but 11. There were 91 iron and steel sailing-ships built and registered during the same time, having a gross tonnage of 126,398.

—The second number of *Appalachia*, vol. iii., has recently appeared. Prof. E. C. Pickering discusses the value of mountain observations for astronomical work, and suggests the use in them of the horizontal telescope, lately devised by him, before which the observer may sit in a comfortable position and in a warm room. Mr. Scott, vice-president of the club, describes a trip to the Twin-Mountain range; and Mr. J. W. Chickering, a longer excursion to Roan Mountain, in North Carolina. Mr. E. G. Chamberlain maps the Blue Hills near Boston, and gives a list of distant points seen from their summit.

Mr. W. O. Crosby presents the results of his studies on the mountain-reefs of eastern Cuba, of which an abstract will be printed in our geographic columns. Mr. J. Tatlock, jun., discusses the variation of barometric measurements with the season. Various reports and proceedings fill about half of the hundred pages. The club's growth in popularity, as shown by its rapidly increasing membership of both sexes, has by no means diminished the scientific value of its publications.

— The general catalogue of the American exhibit at the London fisheries exhibition, referred to on a previous page, and which is now in course of publication, will be followed by a series of special catalogues of the more important sections, which will contain much fresh information regarding the distribution, abundance, and relationships of the species exhibited. The handbooks of two sections — that of the birds, by Mr. Ridgway; and that of the invertebrates, by Mr. Rathbun — are now in press.

— It may not be generally known that Harvard college observatory took an important part in the early experiments made in astronomical photography. Under the direction of Prof. W. C. Bond, the first daguerrotype of a fixed star, and many early representations of other objects, were obtained there. After the invention of the collodion process, Prof. G. P. Bond returned to the subject, and obtained an interesting series of photographs of various celestial objects. While stars of the first magnitude only could be depicted by the daguerrotype, the new process rendered it possible to photograph stars of the fourth. Professor Bond paid special attention to the means afforded by photography for the accurate measurement of double stars. For this purpose he procured numerous photographs of the star Mizar (*ζ Ursae Majoris*), which he afterwards measured micrometrically. The accuracy of the results was remarkable; and the average discordance of the values obtained from the photographs taken on eight different evenings was only 0.3".

— The second part of vol. iii. of *Anales* of the Mexican national museum is devoted to the following papers: 1. Continuation of the study upon the *Piedra del sol*, by Alfredo Chavero; Glossary of Castilian words derived from the Mexican, or Nahuatl, by Jesus Sanchez; Mexican antiquities, by Carlos Fernandez. In the list of Sr. Sanchez are more than two hundred words derived from the aboriginal Mexican, a few of which are already in the vocabulary of the United States; and some of them have become reputable English words, such as, cacao (*cacahuatl*), cocoa (*cocoa*), copal (*copalli*), coyote (*coyotl*), Chile (*Chilli*), chocolate (*pozolatl?*), mezcal (*mexcalli*), mezquite (*mizquitl*), ocelote (*ocelotl*), pinole (*pinolli*), tomato (*tomatl*), tule (*tollin*).

— Professor Aeby has published a diagram of the course of the nerve-fibres in the human central ner-

vous system, which is very warmly praised, and recommended to students and teachers alike. The publisher is Dalp in Bern; the price, 1 mark and 60 pfennigs.

RECENT BOOKS AND PAMPHLETS.

Allieri, L. Equilibrio interno delle pile metalliche secondo le leggi della deformazione elastica. Roma, Loescher, 1882. 119 p., 7 tables. 4°.

Beilstein, F. Handbuch der organischen chemie. Leipzig, Voss, 1883. 2185 p. 8°.

Binzer, J. M. v. Vacuosität und schwerkraft. Nachweis der gemeinsamen ursache der attractions- und gravitations-phänomene einschliesslich der magnetismus auf grund physikalischen thatsachen. Salzburg, Dieler, 1883. 49 p. 8°.

Bottler, Max. Exkursions flora von Unterfranken. Ein taschenbuch zum leichten bestimmen der in Unterfranken, auf dem Steigerwalde und in der Rhön wildwachs. Phanerogamen. Kissingen, Hailmann, 1883. 6+208 p. 8°.

Bowman, W. H. Lecture introducing his system of respiration for the development and treatment of the vital organs of the body. Boston, Mudge, pr., 1883. 30 p. 8°.

Brunbauer, Paul. Der einfluss der temperatur auf das leben der tagfalter. Inaug. diss. München, 1883. 115 p. 8°.

Compte rendu des travaux du service du Phylloxera. Année 1882. Procès-verbaux de la session annuelle de la Commission supérieure du Phylloxera. Rapports et pièces annexes. Lois, décrets et arrêtés relatifs au Phylloxera. Paris, Impr. nat., 1883. 603 p. 8°.

Congrès géologique international. Compte rendu de la 2d session, Bologne, 1881. Bologne, impr. Fara et Garagnani, 1882. 15+661 p., 19 pl. 8°.

Falb, Rud. Meteorologische betrachtungen mit besondere bezugnahme auf die periodischen ueberschweremmungen. Wien, Hartleben, 1882. 6+152 p. 8°.

Gilardini, G. Principio della scienza idraulica italiana. Milan, tip. Osserv. cattolico, 1882. 23 p. 16°.

International (Great) fisheries exhibition. London, 1883. United States of America. A. Preliminary catalogue and synopsis of the collections exhibited by the United States fish commission and by special exhibitors; with a concordance to the official classification of the exhibition. Washington, Government, 1883. 106 p. 8°.

Kempe, H. R. Handbuch der elektrizitätsmessungen. Aus dem englisch übertr. v. J. Baumann. Braunschweig, Vieweg, 1883. 8+308 p. 8°.

Konkoly, Nic. v. Praktische anleitung zur anstellung astronomischer beobachtungen mit besonderer rucksicht auf die astrophysik. Braunschweig, Vieweg, 1883. 22+912 p., 345 cuts. 8°.

Lassalle, C. Origin of the western nations and languages: showing the construction and aim of Punic recovery of the universal language, reconstruction of Phoenician geography, Asiatic source of the dialects of Britain, principal emigrations from Asia, and description of Scythian society. With an appendix upon the connection of Assyrian with the language of western Europe, and Gaelic with the language of Scythia. London, Heywood, 1883. 420 p. 8°.

Maine, Sir H. S. Dissertations on early law and custom, chiefly collected from lectures delivered at Oxford. London, Murray, 1883. 402 p. 8°.

Moncel, Th. du, et Gerdaldy, F. L'Électricité comme force motrice. Paris, Hachette, 1883. 308 p., 112 fig. 18°.

Nebst, E. Moderne instrumentenkunde. Braunschweig, Vieweg, 1883. 22+912 p., 345 cuts. 8°.

New York — Department of public parks. Report of the New York meteorological observatory for the year 1882. N.Y., City, 1883. (13 p.) 4°.

North Carolina — Board of agriculture. Annual report of the agricultural experiment station for 1882. Raleigh, Ashe & Gatling, 1883. 8+150 p. 8°.

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